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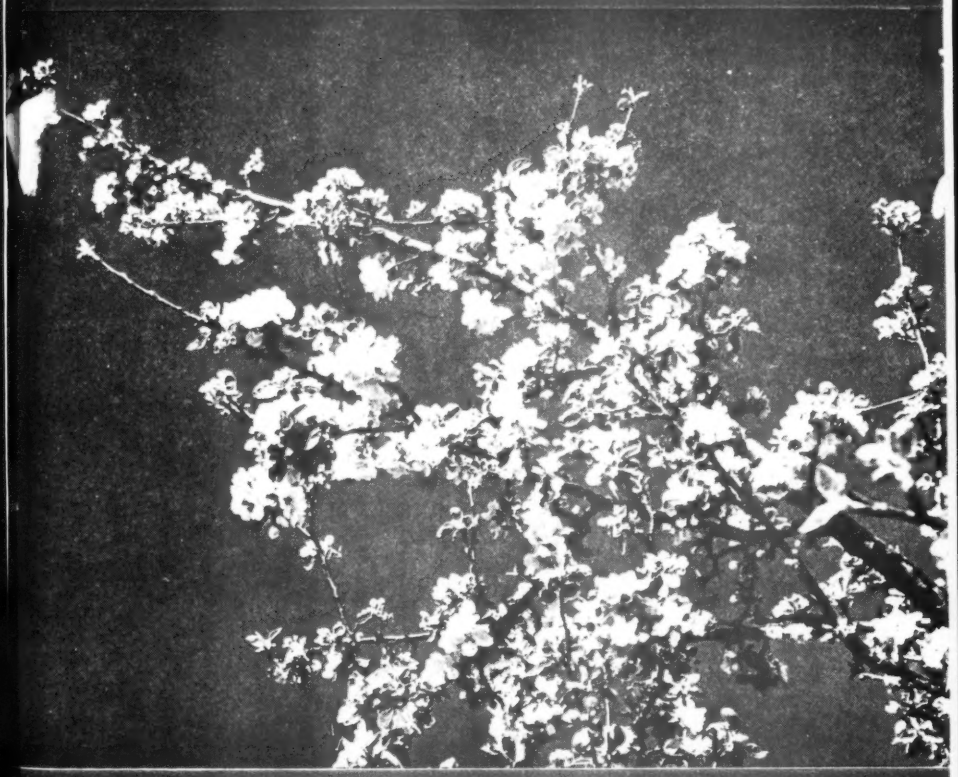

"When April tosses beauty . . ."

Published for the Ministry of Agriculture, Fisheries and Food
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NINEPENCE MONTHLY

Dingle goes dibbling

At first sight this illustration might appear to feature an Early Victorian anticipation of the pneumatic road-drill. Actually, it shows a hand dibbling machine invented in 1846 (the worker's garb, too, is not without interest). The inventor was a Farmer Dingle, and here is the hard core of his lengthy description:

"A quantity of seed is contained in each upper box, which by an ingenious contrivance supplies the receiving box beneath with a regular intake of seeds, which fall into the tube and are thence dibbled in the soil".

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Since its first appearance in June last, the Agricultural Review has built up a world-wide reputation for authoritative views, advice and information (which, of course, was the original intention). Every contributor to its pages is an expert on his particular subject, with up-to-date information to pass on, and the subjects themselves are carefully chosen to be of the widest possible interest.

The April issue maintains the wide range of interest and subject...

F. W. Widdowson, of Rothamsted Research Station, continues an article begun in the October issue—*Improving the Efficiency of Fertiliser Dressings*, a subject of real importance with fertilisers the price they are today!

Dr. R. Coles, in *Egg Quality*, reviews the research findings to date from the twin viewpoints of commercial sales and hatching.

In the past few years plant propogation has made great strides; in *Vegetative Propagation*, Dr. J. P. Hudson, of the Dept. of Horticulture, Nottingham University, reviews the recent advances made in the quicker and more effective ways of building up stocks of valuable plants.

Of general economic interest is F. G. Sturrock's *Full Employment in Farming*—an assessment of the ways in which the farm labour force can be most effectively used.

Three more important articles are: *Lucerne Investigations*, by H. C. Chippindale; *Rape as a Cash Crop*, by C. V. Dadd; and *Marketing—its Meaning and Practice in the Fat Stock Industry*, by T. J. Shaw, Managing Director (Marketing) of the Fatstock Marketing Corporation Ltd.

This is by no means the only content. In addition to other articles, there are also the regular monthly features—book reviews, abstracts from current research papers, and a comprehensive economic review prepared by the Economist Intelligence Unit. The April Agricultural Review is now on sale.

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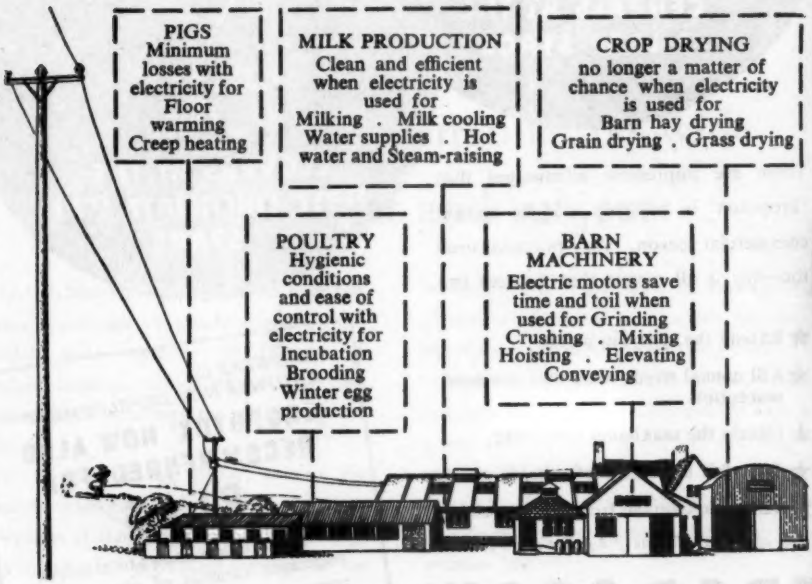

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Cover Photograph

"When April tosses beauty . . ."

AGRICULTURE

VOL. LXIII No. 1 APRIL 1956

SILAGE IN THE ECONOMY OF THE FARM

H. T. WILLIAMS, B.A.

Seale-Hayne Agricultural College, Newton Abbot

Grass, grazed or as silage, and kale are by far the most profitable of our fodder crops. Between them they can meet practically all the food needs of our cattle. Silage has a special economic value, in that it will successfully take care of surplus grass in the flush periods.

IT is very common to approach the question of the comparative merits of fodder crops by comparing the unit costs of nutrients for livestock when derived from the various alternative crops. The most recent of such series of comparative cost figures which I have seen are those given by Hamilton in an article in the November 1955 issue of this JOURNAL.* For convenience, I propose to use these as a basis of some of the arguments which follow. I have roughly checked the figures given by Hamilton with such figures as are available from other sources, and have found that they tally reasonably well, except perhaps that the yield of grazed kale is set rather low in relation to kale cut and carried, and that mangolds are made to appear a little more expensive than they are normally considered to be. Nevertheless, relationships between the costs of different foods are reasonably in accord with the results of alternative investigations, and it is of course the relationship one to the other, rather than the absolute level of cost, which is of greatest importance in determining the relative merits of each. I have taken the liberty of repeating Hamilton's figures in Table 1.

Table 1

Estimated Cost of Starch Equivalent for Various Crops and Dairy Cake in 1954

	Average Yield per Acre *tons*	Cost of Starch Equivalent *£ per ton*
Grazing (effective production)		11
Early-bite (effective production)		14
Grass silage	5.2	17
Kale, grazed	14.0	17
Kale, cut	20.0	18
Hay	1.7	20
Oats, half straw-fed	1.2	28
Fodder beet, roots	12.0	33
Tillage silage	6.0	34
Dried grass	1.6	40
Mangolds	25.0	40
Dairy cake at £35 a ton (65% S.E.)		54

* Utilization of Grassland (1). R. A. Hamilton. p. 375.

The figures show clearly that grass in the form of grazing is cheaper than all other forms of feed and that grass conserved as silage ties for second place with kale grazed. It would greatly simplify farm planning and management if cropping decisions could be taken on such simple and straightforward figures. Unfortunately, this cannot be done.

The purpose of farming is to obtain the highest continuous level of profitability from all the farming resources—land, labour and capital—taken together, and the place of silage or any other fodder can be determined only in relation to the contribution which it makes to the total profitability of the farm. This being the case, the cost per unit of the product is only one of the factors that influences total profitability. There are two other factors. One of these—namely, the price which he receives for his final product—is largely outside the farmer's control; the other, which is within his control, is the total volume of production.

Consider Crop Potential It is very important therefore, in determining the place of any enterprise, fodder crops included, in the farm economy, to look at both the factors which are within the farmer's control. That is, attention must be paid not only to unit cost of production, but also to the potential of each fodder crop in terms of the volume of production which it will support, and the total contribution which it is likely to make to farm income in relation to the resources devoted to it. To illustrate this, I have constructed the rather formidable looking, but really quite simple, Table 2.

Table 2

Relative Profitability per Acre of Various Fodder Crops devoted to Milk Production

Crop	1 Estimated S.E. per Acre	2 Cost of S.E. per gal. for M'tce and Prod. (*a*)	3 Assumed Non-feed Costs	4 Assumed Price (*b*)	5 Profit Margin (*c*)	6 Gallons Produced per Acre	7 Total Margin per Acre
	cwt		*pence per gallon*			*gal*	*£*
Grazing	17 20 22	7.1	12	38	18.9	317 373 411	25 29 32
Silage	22	10.9	12	38	15.1	411	26
Kale, grazed	28	10.9	12	38	15.1	523	33
Kale, cut	40	11.6	12	38	14.4	747	45
Hay	14	12.9	12	38	13.1	261	14
Oats	17	18.0	12	38	8.0	317	11
Arable silage	13	21.9	12	38	4.1	246	4
Dried grass	25	25.7	12	38	0.3	467	1
Mangolds	31	25.7	12	38	0.3	580	1

(*a*) Based on a yield of 720 gallons.
(*b*) The price assumed is the weighted average pool price, including quality premiums and production bonus,as stated in the 1955 Review White Paper, Cmd.9406.
(*c*) Col. 4 less Col. 2 and 3.

The sole purpose of this table is to show the relative magnitude of profits to be derived from land devoted to the various fodder crops, and to underline the importance of yield or volume of production, as well as unit cost, in any consideration of the relative merits of the different fodders.

Column 1 of Table 2 gives the yield in terms of starch equivalent of each of the crops, according to Hamilton, except in the case of grazed grass, for which he does not quote any yield figure. For grazing, therefore, I have assumed three levels of yield, the lowest somewhere near the estimated average for the United Kingdom, and the other two representing slightly higher yields which might be found under moderately good management. Column 2 represents the cost per gallon of the starch equivalent required for the maintenance and production of a 720-gallon cow, if the whole of the starch equivalent was derived in turn from each of the fodder crops. Column 3 represents the costs per gallon other than feed, and consists of labour in milking and care and attendance upon the cow, and other costs, mainly of fixed character. The figure of 12 pence per gallon is based on the results of the Milk Cost Investigation of England and Wales.

The assumed price per gallon shown in Column 4 is somewhere near the average price of milk, and Column 5—the estimated profit per gallon—is calculated by deducting total costs per gallon from the assumed price realized. Column 6 shows the yield in gallons per acre of each of the fodder crops on the basis of a requirement of 6 lb of starch equivalent for maintenance and production of each gallon of milk. Column 7, which is arrived at by a simple multiplication of Columns 5 and 6, gives the total profit per acre.

The final column is the one which is of interest. In terms of profitability per acre, kale cut and carted out-yields all other crops, followed, probably more closely than these figures suggest, by kale grazed and then by grazing at the higher levels of management, which is in turn followed by grass silage. All other fodder crops in this series fall well below the various forms of kale and grass in terms of the contribution they can make to profitability per acre of land devoted to them.

To get the greatest profit from any given area of land devoted to milk production, or for that matter to any stock which can use these crops, the aim should be to concentrate on kale, grazing and silage, in that order of preference to the fullest extent possible under the physical and climatic conditions of the farm and the fullest extent to which the animal can use them.

Labour a Limiting Factor It would be comforting if we could leave the comparison at this point, with a comparatively clear and unequivocal conclusion. Again, unfortunately, this is not possible. In the argument up to this point it has been assumed that the problem of maximum net income for any farm is identical with the problem of maximizing net income per acre, and in doing this it is assumed that land is the fixed or limiting factor, and that all the other factors of production are unlimited. This, of course, is frequently not the case. Nowadays, on quite a few farms, labour has become as much a limiting factor as land. It is interesting, therefore, to construct a further table, substituting labour for land, and calculating the relative profitability of each hour of labour devoted to such production, based again in turn on each of the fodder crops. The results of this calculation are shown in Table 3.

The steps and the principles of the calculation in Table 3 are similar to those of Table 2, and it is not necessary to explain it in detail, except perhaps to say something about the first column. Column 1—the estimated labour requirement per acre—has been taken from the Ministry's booklet, *The Farm as a Business**—except for grazing and silage, on which the Ministry is silent.

* H.M. Stationery Office. 4*s*. (4*s*. 3½*d*. by post).

For grazing, therefore, I have based the requirements on the Milk Cost Investigation results for 1951-52, which are corroborated by our experience at Seale-Hayne. The two levels of labour requirements given for silage are also based on experience at Seale-Hayne, and represent a range within which, under moderate conditions of farm layout and management, one would expect the requirements to fall. They include, of course, all the labour in establishing and producing the grass as well as labour expended in making silage.

Turning to Column 7, which is again the important column, estimates are shown of the profitability of each hour devoted to milk production based on the various fodder crops. These figures alter the picture. In terms of profitability per hour of work, milk production based on grazing becomes

Table 3

Relative Profitability of Labour devoted to Milk Production based on Various Fodder Crops

Crop	1 Labour Required Per Acre (*a*)	2 S.E. Produced per Hour of Labour	3 Milk Produced by S.E. Product of 1 h Labour (*b*)	4 Direct Labour Req'd for Gallonage Shown	5 Total Labour Req'd for Gallonage Shown	6 Total Profit Margin (*c*)	7 Profit Margin per Hour (*d*)
	h	*lb*	*gal*	*h*	*h*	*s.*	*s.*
Grazing	3	635 747 821	106 124 137	21 24 26	22 25 27	167 195 216	7.6 7.8 8.0
Silage	20 30	123 82	20.5 13.7	4.0 2.7	5.0 3.7	26 17	5.2 4.6
Kale, grazed	40	80	13.3	2.6	3.6	17	4.7
Kale, cut	100	45	7.5	1.5	2.5	9	3.6
Hay	25	62	10.3	2.0	3.0	11	3.7
Oats	29	66	11.0	2.1	3.1	7	2.3
Arable silage	26	56	9.3	1.8	2.8	3	1.1
Dried grass	.....	.....	Not Available	.....	.....	.....	.....
Mangolds	150	24	4.0	0.8	1.8	−2d.	0.5

(*a*) The labour requirements are, wherever possible, those given in *The Farm as a Business*.
(*b*) Col. 2 divided by six, assuming 6 lb S.E. per gallon required for maintenance and production.
(*c*) Col. 3 multiplied by Col. 5 of Table 2.
(*d*) Col. 6 divided by Col. 5

decidedly the most profitable, followed by grass silage, with kale grazed falling into third place. Kale cut and carted falls from the first place which it occupied in terms of profitability of land use to fourth place in terms of profitability of labour use.

Just as profitability in relation to land and labour has been calculated, one could also calculate it in relation to capital, but I have not done this because, as far as the nearest rivals are concerned—that is, grass, grass silage, and kale—the capital requirements, in the sense of necessary specialized equipment, for grass and kale are nil, and for silage they can be almost negligible. Indeed, very careful investigation over the last two years at Seale-Hayne has convinced us of the superiority of the buck-rake in cheap-

ness and speed of working over a much wider range of distances and conditions than is normally thought to be the case: and the buck-rake involves no great capital outlay. In view of this, a comparison on the basis of the return on capital would not be likely to lead to any conclusions, one way or the other.

Grazing, Silage and Kale At this point the conclusion is that where land is the limiting factor, the emphasis on silage should be less than that on kale and grazing. Where land, on the other hand, might be more plentiful relative to labour, the emphasis should then be on grazing, grass silage and kale in that order. What it means in practice is that the smaller the farm, the greater the emphasis should be on kale, and that even on the large farm, to the extent that labour is available, it will pay to make as much use of kale as possible.

These three foods, together, are capable of providing the total feed requirements of our ruminants, other than perhaps our highest yielding dairy cows, where the addition of some concentrates may be necessary. In any case, the advantage of kale and silage over the other bulky fodder crops is striking. Mangolds, usually grown to fill the gap between the last of the kale and the beginning of the grazing season, seem to be particularly uneconomic. Precisely the same function can be performed by silage, at a much lower cost.

None of the foregoing should be interpreted as an argument for self-sufficiency. There are clearly limits imposed by the capacity of individual animals to make use of bulky fodder crops, although these limits can be pushed farther back by developing the right type of animal, and especially by concentrating on the quality of grass and silage produced. Nevertheless, there will still be many instances where an extra gallon or an extra pound in weight can profitably be achieved by the addition of concentrates, whether bought or produced on the farm. What is wrong is to buy expensive feed while there is an unused capacity to produce its equivalent on the farm.

Silage from Wasted Grass There are two final points which should be made concerning the place of silage. First, it is notorious that in this country there is a wide gap between the grass produced and that used. The wastage is mainly due to the fact that to be sure of enough grass in the lean periods, a surplus cannot easily be avoided in the flush months by grazing and haymaking alone. Even if only to make use of this surplus, silage should have an important place in any grassland system. Moreover, the cost of making it is the only cost in this case, since the grass is there anyway. Secondly, it is paradoxical that in very many instances the reason why such surplus grass is wasted, or at best made into inferior hay later in the season rather than made into silage at the right time, is that farm labour is devoted at the critical time to high labour-consuming root crops, which on straight economic grounds are not worth considering. It might, therefore, be a better approach to the problem of efficient grass utilization to work for a substitution of silage for these crops in the first instance, and after that to consider the substitution of silage for hay as a more efficient means of conservation in terms of land and labour use.

PROFIT MARGINS ON A SMALL DAIRY FARM

H. E. EVANS, B.Sc.(Agric.), D. T. EVANS, B.Sc.(Agric.) and E. M. THOMAS, B.Sc.(Agric.)

National Agricultural Advisory Service, Wales

An examination of the management on an above-average 50-acre dairy farm in Carmarthenshire points to ways in which the present low profits of small farms in the area can be increased without making heavy demands on capital or labour.

FROM the farm management point of view, the problems that face the small dairy farmer in Carmarthenshire and, indeed, in Wales as a whole, are manifold. The system of farming lacks flexibility, there are seldom facilities for profitable cash cropping, farm buildings are often inadequate for the development of supplementary enterprises, regular labour is generally short and casual labour is almost unobtainable. Capital in many instances has to be amassed from profits and tends to be limited, so, in turn, profits tend to be small. Some figures prepared by the Department of Agricultural Economics, Aberystwyth, and based on a survey of 39 Welsh dairy farms in the 50-99 acre group, serve to confirm this last point.

	Average	Above Average
	£	£
Net farm income	472	1,364
Labour of farmer and wife	375	414
Enterprise profit	97	950

On the other hand, Carmarthenshire has much in its favour. The climate is moist and humid, with cool summers and mild winters—admirable conditions for exploiting grassland husbandry and intensive forage cropping. The farmers are innately good stockmen, even though biased rather heavily perhaps in favour of cattle and sheep, and having relatively little interest in pigs and poultry.

What follows is a case study of a typical small dairy farm in west Carmarthenshire where the farm income is reasonable. An attempt will be made to explain the factors contributing to its success and, at the same time, point out lines for further improvement. The farmer is loath to have his farm named, lest he be accused of boasting, but this need not detract from the lessons pointed. A broad picture of the acreage under crops, grass and stocking is given below.

Crops and Grass	*acres*	Livestock	
Mixed corn	2½	Cows	17
Roots	½	Females over 2 years	3
Kale	4	Females 1-2 years	1
Grass for silage	8	Under 1 year	4
Grass for hay	12	Sows	1
Pasture	25	Poultry	60
Total	52		

The farm is situated on the west Carmarthenshire plateau, some 10 miles north of the Bristol Channel at an elevation of 400-475 feet: the annual rainfall is in the region of 50-55 inches. The soil is a medium to heavy loam

based on the Silurian formation. Such soils are eminently suitable for grass production, though liable to poach in the winter. Lime and phosphates are particularly short and have to be applied regularly. The farmer and his wife do most of the work, but they are extremely lucky in being able to employ casual labour at harvest time and on odd days—equivalent, say, to one man for five weeks in the year. Under these conditions the farm has to be well equipped with machinery, especially for dealing with the hay harvest, silage-making and manure distribution.

High Output, Low Costs An examination of the farm budget shows that the enterprise is almost wholly devoted to milk production; the poultry and pigs provide only a small part of the gross income. But it is evident from the figures below that the gross output per acre and per £100 of labour costs, together with the expenditure on fertilizers and sales per cow, are higher than the standard for similar farms. These are the strong features of the farm enterprise.

	Year ended September 30, 1955	Standard
	£	£
Gross output	2,542	—
Gross output per acre	48.8	35.17
Gross output per £100 labour, including farmer and wife	431	344
Gross output per £100 capital	103	112
Costs per acre, including labour of farmer and wife ...	32.2	32.5
Net farm income per acre	27.2	8.5
Livestock production per livestock unit	106	80.6
Livestock production per £100 purchased feed ...	458	329
Fertilizer cost per 100 acres	230	142
Sales per cow	117	100
Labour efficiency index (*per cent*)	90	100

It is axiomatic that high profits and high turnover are closely related, but the key to the whole problem is the ability of the farmer to ensure that a *fair* proportion of the turnover remains in his bank account as profit. Costs must be kept as low as possible for this to happen, and low costs are a reflection of good management. On this farm, costs are kept down by the following methods:

1. High production of grass from leys by the intelligent use of fertilizers.
2. A sound policy of grass conservation, half going for hay, and half to silage—a very wise procedure in an area with such a heavy rainfall.
3. Adequate use of high protein forage crops like kale.
4. Feeding according to milk yield.
5. Rearing of young stock for replacements is kept to a minimum (about 8 young stock in relation to 17 cows), thus allowing the bulk of the crops to be cashed as milk.

The low replacement rate is quite possible in such an area where attestation has been the rule for fifteen to twenty years, and where standards of herd hygiene are high.

An examination of the feed budget reveals that home-grown foods provide for maintenance and the production of 1½ gallons of milk per cow per day. The cows are given 4 lb purchased concentrates per day for the extra gallon, to give a yearly average of some 750 gallons per cow.

The importance of a *rational* policy of self-sufficiency based on grass and forage crop production as a prerequisite to cheap milk production is borne out by the low milk cost figure for this farm. For the year October 1953–September 1954, it was calculated by the Department of Agricultural Eco-

nomics at Aberystwyth to be 16.4*d*. per gallon. The best use must be made of the farm's natural resources before high profits can be achieved from the use of purchased concentrates, and it is impossible to overstress the importance of this factor. It has to be admitted, however, that farm management studies often indicate the absence of this basic essential and show very definitely that the impact of purchased feed occurs far too early in the process of milk production, thus raising costs to levels which are dangerously near the realization value of the milk. This is not to imply in any way that good profits cannot be attained by the use of hay and liberal quantities of purchased concentrates, but very few managers can do well under these conditions. It is much more usual to see purchased feed being fed at rates which not only cover production and maintenance, but often leave some in reserve, presumably to be used for the sole purpose of fertilizing the land. Such a situation is not only uneconomic, but results in waste of farm resources and overall inefficiency.

The management on this particular farm can be criticized mildly on one or two counts. In the first instance, there is a little slack to be taken up on labour efficiency. On a family farm of this type, labour efficiency cannot be the subject of strong criticism, but the farmer thinks that it is a matter that can be corrected, and certain suggestions will be made to erase this slight blemish.

Secondly, working capital in relation to turnover is higher than average. An analysis of the inventory brings out the weakness on a farm of this size and type. The capital invested in machinery is rather high, amounting to some £900-1,000. This is a fault found on many farms in the area, and is due to several causes. Farms of this size have to mechanize to cope expeditiously with the hay harvest, and it is difficult to arrange to share machinery under these conditions. Labour is short, and thus machines, though used only for short periods, are needed to fill the gap. It must also be admitted that the Carmarthenshire farmer has become very fond of machinery for its own sake, and is apt to look on implements as " collectors' pieces ", instead of as expensive supplements to his labour force. The only way to circumvent this over-mechanization is to increase turnover, thus attenuating the effect of such overheads on unit costs.

Possible Improvements A farm management study would be a poor tool if it were designed only to diagnose weaknesses on any particular farm or enterprise. Of necessity, it must also prescribe the remedy, and a tonic as well. The following suggestions for improvements have been discussed with the farmer, and are likely to be adopted by him in the near future.

There is ample evidence from farm management studies made in the county that on land of this calibre a more intensive fertilizer application of up to £5 per acre will enable this farm to grow sufficient feed to cover maintenance and the production of 2-2½ gallons per cow per day, and also allow a slight increase in the size of the herd (from 17 to 20 in this particular case). Increased grass production, lengthening of the grazing season, a greater emphasis on conservation of grass as silage at the expense of hay, and possibly, a slight increase in the kale acreage, should provide for the extra food needed.

If this is carried out, there is a case for more purchased feed, for where the maintenance of the herd and the production of the first 2 or 2½ gallons is based on a sound, cheap foundation, it becomes perfectly obvious that increased use of purchased feed at the rate of 4½-5 lb for each extra gallon above the first 2 gallons is a sound economic proposition. The costing for

the production of an extra 1½ gallons per cow per day above the production of 2 gallons obtained from the farm's resources, will work out approximately as follows:

Winter Milk (180 days)

	£
Purchased feed for 10 freshly calved cows giving 1½ gallons more per cow per day @ 7½ lb per cow	190
Increase in milk receipts, 15 gallons per day for 180 days @ 3*s.* 3*d.* a gallon	438
Profit margin	248

At present, some 60 head of poultry are kept in batteries and perform quite satisfactorily. There is little room for expansion in this direction, without becoming involved in a fairly heavy capital expenditure on new housing. Moreover, the farmer's wife helps with the livestock and, since she has to do all the housework herself, she is not inclined to add to her many tasks. But there is a very good demand for store pigs at Carmarthen, and a small pilot scheme was set in motion on the farm this year to breed from one sow and sell the weaners at 10-12 weeks old. To date, the results have been highly satisfactory, the first litter of twelve realizing £72.

Although conditions are not always so favourable as in this first season, the farmer intends to increase the breeding sow unit gradually to nine or ten. The sows will be folded on clover, chicory and grass mixtures, supplemented with meal, and they will be brought in when due to farrow. Under these conditions, outside housing will be cheap, and reasonable farrowing accommodation is already available in the farm buildings. Gross output should increase by £900-1,000 a year, and profits by £180-200. In addition, the ground over which the sows are folded will be in no mean state of fertility, and should grow increased crops of kale for the benefit of the milking herd. It is hoped that this enterprise will take up the slack in labour and so improve the labour efficiency index.

The Road to Higher Profits What moral can be drawn from this examination for the benefit of other small dairy farms in the moist and humid west? Briefly, the conclusion is that reasonable profits can be made provided:

1. Farms utilize to the full the inherent capacity of the land to grow good grass and forage crops.
2. Where a sound rational policy of self-sufficiency has been adopted and net production from the farm provides for maintenance and the first 2 or 2½ gallons, then turnover and profits can be increased appreciably by the intelligent use of purchased feeds. It is worthwhile to note also that under these conditions such a feeding policy acts as a buffer against the effects of any rapid increases in the price of feedingstuffs in world markets.
3. Supplementary livestock enterprises, provided they interest the farmer, make only limited demands on capital, are within his reach from the point of view of labour, and add materially to the turnover and profit margins.

MYXOMATOSIS AND THE BALANCE OF NATURE

H. N. SOUTHERN, M.A.

Bureau of Animal Population, Oxford

In this talk, recently broadcast in the Third Programme of the B.B.C., Mr. Southern describes how the advent of myxomatosis in a thousand acres of woodland where he was making an ecological study, radically altered the balance of the natural population.

MOST people whose work or pleasure takes them into the country will have noticed for themselves some of the immediate effects of the disappearance of rabbits. Corn crops have flourished right to the margin of the fields; seedling trees (not excluding the unwanted thorn) are romping into every open space; the grasslands, especially on the chalk and limestone, have changed from close-cropped turf to a sea of waving grass-heads; and the spring flowers excelled themselves in beauty and abundance.

But these are just the superficial and temporary effects of a readjustment in the balance of animal and plant communities which is a far more radical affair. Whether the rabbit eventually comes back to its old level or not, far-reaching oscillations in animal and plant populations will go on for some time. And it is up to the ecologist to try and measure some of these changes and to extract what information he can about the complex control that animals exercise on each others' numbers. On the botanical side, much research work has already been started to measure the changes that myxomatosis has set going. I want to speak particularly about wild animals.

Now the kind of research that investigates the balance of numbers in animal populations is enormously time-consuming and needs special techniques, such as the marking and releasing of big samples of the animals studied, which are subsequently recaptured and identified. Obviously then, such widely devised schemes of investigation must be few and far between.

Here I was exceptionally fortunate. For some eight to nine years I had concentrated my energies on trying to discover, in terms of population density, the impact of predation by owls on the numbers of their prey—wood mice and voles. This work was done on an area of about 1,000 acres of deciduous woodland and it involved designing and operating methods of making a census both of the owls and of the wood mice and voles. I had hoped to complete the field work for this study in 1952 but, after a year or so brooding on the results, I became convinced that some serious error had crept into the figures for the prey populations. So by October 1954 I had gone back into the woods and restarted a series of two-monthly trappings to catch and mark large numbers of mice and voles. The scale of this kind of experiment can be judged from the fact that between 1948 and 1952 I and one assistant handled over 10,000 of these small rodents, and walked above 1,000 miles in the process.

No sooner had I started again than myxomatosis arrived. In six weeks it had cleared practically every rabbit out of the estate. A well-timed fall of snow in early 1955 confirmed this, for in spite of careful searching, only about three rabbit tracks could be found on the whole 1,000 acres.

Fewer Mice and Voles Almost immediately there were signs of unusual activity by foxes. On the estate there are two small plantations of conifers, not more than 20 acres in all, where the ground

is bare of vegetation. These are inhabited by wood mice which make their network of burrows just below the level surface of the pine needles. And beyond these plantations there are also occasional patches throughout the woodland where the soil is thin and the ground all but bare. In such places as these the foxes had dug extensively along the lines of the underground burrows and large areas were seamed and criss-crossed with the results of their altered hunting habits. Everyone who has watched foxes knows of course that, among other things, they are inveterate "mousers" and have a characteristic method of waiting alertly to pounce with an upward spring upon mice and voles in the herbage. This excessive and widespread digging up of the forest floor was a new phenomenon to me and suggested that the foxes were indeed hungry.

By springtime the repercussions from the dearth of rabbits were competing for attention. In the first place, live-trapping for mice and voles showed that there had been a spectacular decline in their numbers. Any increase in mortality at this time of year has a particularly stringent effect because breeding has not yet started and populations are at their lowest seasonal ebb. In a normal nine-day trapping period I can, with the help of one assistant, usually catch about 400 animals, of which nearly half are wood mice. In the spring of 1955 I had to extend the trapping period to eleven days and even then it was touch and go whether we would reach a total of 100 animals. Of these, only some 20 were wood mice. Here indeed was what we might call a "crash" in the population, more severe than I ever recorded before. I have no doubt in my own mind, though the evidence is circumstantial, that the altered feeding habits of foxes, stoats, and weasels must have produced this effect.

The effect of this dearth of mice and voles upon the population of owls was even more striking. In a normal year most of the twenty-five pairs of tawny owls on the estate attempt to breed and about half are successful in rearing young. The broods are about equally divided between ones and twos, so that the average number of chicks fledged on the estate is about twenty. In 1955, in vivid contrast, only four chicks were fledged. All these were singletons, which probably meant that a brother or sister had died of starvation in the nest; and even of these four, one chick disappeared soon after it was fledged, which is very unusual. This striking reduction from some twenty chicks to effectively three gives an index of the low ebb to which the mice and vole population had sunk.

During the trapping of the small rodents it was clear that the reduction of numbers was unevenly distributed. Large parts of the trapping area were almost devoid of mice, but in some places, notably where there was a dense ground-cover of bracken and brambles, it was still possible to trap a number of bank voles. It was just in these areas that the few tawny owl chicks were successfully reared. So the connection between available food and the breeding success of the owls was most satisfactorily demonstrated.

Changes in Feeding Habits The spring flowers had shown by their exceptional exuberance that rabbits normally take a heavy toll of them. Cowslips, particularly along the meadows edging the woodlands, flowered in great carpets, and many species that are humbler in habit—the wood sorrel, moschatel and woodruff—thrust themselves upon our attention by their virile growth. Of course, some of this release would be due as much to the secondary dearth of mice as to the primary dearth of rabbits. This fact became clear to me when I examined the bluebell buds pushing out of the ground in April. Usually a small proportion of these are found shredded to pieces with the debris lying on the ground beneath. This

is the work of the wood mouse. But in 1955, although I searched hard, I could find no examples of their typical pillaging. Even if I had not already known it from the results of trapping, this would have told me that the normally ubiquitous wood mouse had been reduced to a very low level of population.

Various subsidiary lines of evidence also pointed to a shortage of small rodents in the woodland and a consequent change of feeding habits by the animals and birds that normally prey upon them. Successively, a stoat and a weasel were poked out of grey squirrel dreys, one at least 50 feet up an oak tree. Foxes became a nuisance to poultry on surrounding farms, and their numbers had to be reduced. Badgers were also troublesome in this way during the summer, but I think this belongs to another story. The long drought prevented them from getting at their staple diet of earthworms, and the notable absence of wasps meant that there were hardly any nests for the badgers to dig out. In a normal summer the forest floor bears frequent traces of these activities, and in an afternoon's walk I have counted as many as twenty wasps' nests scratched up and the comb pulled to pieces by badgers.

Oscillation or a New Equilibrium? So far, anybody with even a slight knowledge of ecology could have predicted most of these changes in the balance of animal numbers following the disappearance of the rabbit. The most exciting part is still to come. It seems to me that there are two main possibilities. If the lack of small rodents presses really heavily on the birds and beasts of prey, then their numbers will in turn be reduced. This should again release an upsurge in the quickly breeding mice and voles, with the result that 1956 should stimulate the breeding of the predators and they should have a "boom" year to follow the catastrophe of 1955. Fortunately, as far as the tawny owls are concerned, it will be possible to check whether this happens.

Such a sequence of staggered oscillations in numbers is what mathematicians predict for populations of prey and predator in a closed system. On the other hand, such an oscillating system has not yet been observed, even in laboratory populations. In the wild, the numbers of animals, unless disturbed by a violent and far-reaching epidemic, like myxomatosis, remain obstinately on the level—with certain exceptions: this, despite the potentialities of fluctuation indicated by their birth rates.

This brings us to the second possibility: that this comparative stability of natural populations will quickly reassert itself, and the buffering effects of adaptability in the habits of animals—adaptability, that is, in turning to alternative foods or in temporarily depressing production of young—will work out a new equilibrium. There are some signs of this already. Although the number of young produced by the owls in 1955 was remarkably low, I have seen no signs yet of any reduction in the number of adults. They have apparently been able to spread their diet to include alternative prey—a sort of biological shedding of the load—and so to keep themselves going until they can resume full-scale productivity. The same seems to be true of foxes. I have examined half a dozen or so that paid the penalty for their interest in chicken coops, and not one was emaciated.

This failure of mathematical and laboratory predictions to be borne out in the field is perhaps one of the most fascinating problems in ecology. The widely variable buffering effects that exist in the network of a wild animal community seem capable of absorbing the most staggering shocks. Perhaps in the end they will also take in their stride this sudden and wholesale elimination of rabbits.

With these indications of the likely course that events may take, there is now nothing to be done but wait and see. During the late autumn and early winter there were signs of a recovery in the populations of mice and voles. When I last put out my live traps at the turn of the year, I once again got a full-size catch, and there were obviously great numbers of youngish wood mice flooding in from the tail-end of the breeding season. The effect of this recovery on the breeding of the tawny owls, which starts about the middle of March, will be watched with particular care.

Buzzards Cease to Breed I should mention the one other extensive piece of research on the repercussions of myxomatosis among wild animals. This has been done by Dr. Norman Moore of the Nature Conservancy. In Great Britain his subject of study, the buzzard, preys extensively on rabbits and lives mainly in the pasture land and rough grazings of the west—always a notorious area for rabbits. The effect of myxomatosis has been most striking: except where pockets of rabbits temporarily escaped the disease, buzzards did not breed at all in 1955. The effect on the buzzard population has perhaps been more severe than on the tawny owls because they have wandered widely—presumably in search of food—and have been shot down in numbers by irate chicken farmers and game-keepers.

The buzzard and the tawny owl represent only two of the many points in the web of British wild life where the impact of myxomatosis can be measured. The total effect must be tremendous and far beyond our capacity to measure critically. Nevertheless it is valuable to have a finger on the pulse of events at even two points. And in this country we may claim to be doing as much as anywhere else that has been swept by the lethal virus to learn from the catastrophe.

GRASSING DOWN OF ORCHARDS

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Experience in the Eastern Counties suggests that a timothy-white clover mixture is the most suitable for grassing down orchards. But attention must be given to establishment and management if its full potentialities are to be realized.

UNTIL comparatively recently an all-arable orchard was the accepted practice on the 50,000 or so acres of the Eastern Counties which are devoted to the cultivation of top fruit, although occasionally some use was made of weeds for soil humus. Within the last few years, however, there has been a gradual appreciation of the value of a grass sward, and today an arable orchard is a much rarer sight. Unfortunately, this change-over was often made at a time when there was very little information available as to the best type of cover, and this, together with close cutting, has tended to retard the development of suitable swards.

The grassing down of orchards was first considered at length, as far as the Eastern Counties were concerned, at Cambridge in 1949, when ex-

perienced opinion was expressed by growers in support of grass on the grounds that it eased movement considerably and avoided undue compaction of the soil by heavy spraying tackle. In addition, the effect of certain mineral deficiencies was reduced, and fruit colour was generally better. At that time growers were concerned about the need for a better soil structure, and it was felt that the sward would help achieve this through its extensive root system, as well as by its direct contribution to soil humus. The effect of a grass cover on soil moisture remained a subject for speculation.

A Survey of Orchard Swards Following this meeting, a survey of orchard swards was made in the Eastern Counties. The examination revealed three main types of cover: (a) natural swards, popularly known as tumble-down types; (b) white clover only; (c) perennial ryegrass and white clover. Tumble-down swards are the result of the natural weeds "taking over". Weed grasses, such as creeping bent, annual meadow grass and Yorkshire fog, generally contribute most to this kind of ground cover, but, because of the shallow rooting habits of these species, the resultant sward will not withstand dry summers. The examples seen were characteristically greasy and cut up badly under traffic.

Where only white clover was used, both the larger, more robust type, such as S.100, Kersey or New Zealand, as well as the smaller, more persistent wild white clover (Kentish, S.184 or local English) were found. Some excellent swards were seen, particularly in the first season after sowing. But generally, due to the practice of close cutting and, in some cases, as a result of soil acidity, the clovers had died out and the native grasses and weeds had crept in to bring about a tumble-down condition. White clover, being shallow-rooted, was not able to contribute markedly to soil humus. The sward was typically greasy and rutted under wheeled traffic. Generally, however, growers favoured white clover, on account of its contribution to soil nitrogen.

The most common type of sward found in the survey was the perennial ryegrass–white clover mixture, and this was felt to be a considerable step forward in the development of orchard ground cover. Mainly Kentish and S.23 strains of ryegrass had been used with either Kent wild white or S.100 white clover as a companion. Perennial ryegrass is quick to establish itself, and its ability to produce an abundance of early growth for frequent cutting back for soil humus had favoured this grass. There is, however, some evidence that this rapid early growth tends to compete with the demands of the fruit trees in spring, and the theory that these frequent cuts provide a source of soil humus is now not so widely held. More reliance is being placed on grass roots for this purpose. The frequent cutting required denies the ryegrass an opportunity of developing an extensive root system, and this limits its suitability in orchards. Ryegrass is more suited to moist conditions; in dry situations growth is seriously restricted and individual plants become drawn. This results in the development of a patchy, open sward in the normal Eastern Counties' summer. The open character of the ryegrass sward, which exposes the soil to summer heat, is also felt to be detrimental to the fruit tree. The aggressiveness of ryegrass tends to smother clover, and again the close cutting of such swards further weakens the clover so that it cannot recover and help to fill the open spaces.

Trials with a Timothy-White Clover Mixture It was obvious from this survey that the types of cover normally used left much to be desired. What was needed was a cover which would require less cutting than the ryegrass sward and which would

achieve the best cushioning for traffic. It must produce ample root fibre and contain plenty of clover. Preferably, the grass should be late in spring growth so as not to interfere with the trees at this time of year.

As a result of the breeding work at the Welsh Plant Breeding Station, Aberystwyth and elsewhere, there is a wide choice of grass and clover strains for such work. In particular, the pasture strain of timothy (S.50) seems especially valuable, on account of its vigorous yet short habit of growth, late spring growth, high tillering capacity, and ability to grow in association with white clover. Another useful short-growing, high tillering grass is S.59 red fescue. Reference has already been made to the need for a vigorous white clover, and the choice here appears to be either S.100 or Kersey white clover. The seeds mixture prepared for trial purposes was therefore basically S.50 timothy with one or other of the larger white clovers. To contribute further to sward density, and to help establishment, red fescue and wild white clover were added in small quantities to give the following:

	lb per acre
Timothy, S.50	8
Red fescue, S.59	3
White clover, S.100 or Kersey	2
Wild white clover, Kent or S.184	1
	14

Mention should be made that only the S.50 strain of timothy was used; experience shows that other strains of timothy are unsuitable for orchard grassing.

Due to the interest and co-operation of several growers in the Eastern Counties, trial seeds mixtures were sown from the spring of 1950 onwards on different soils under a rainfall of about 20 inches a year.

Modifications were occasionally made to the standard mixture in regard to seed rates, and small quantities of perennial ryegrass and smooth-stalked meadow grass were included in some instances. The establishment of the latter was generally indifferent—due possibly to too much shade—and it was therefore not persevered with in the standard mixture. Where it did become established, it made a useful contribution as a bottom grass. The inclusion of red fescue in the standard mixture proved valuable when white clover became dominant and depressed the timothy. In these instances red fescue held the ground and prevented the encroachment of weeds. Perennial ryegrass, despite a low seed rate, soon dominated the sward.

Several alterations were made to the standard mixture in an endeavour to reduce costs. Some growers tried reducing the seed rate of the timothy to 4-6 lb per acre, but generally the lower rates produced gappy swards which allowed in too many weeds during the seeding year. There was, however, one outstanding case where, presumably under ideal conditions of soil and weather, timothy sown at 2 lb per acre produced a good sward along with the white clover.

In another instance S.100 white clover was left out of the mixture, but it was evident in the resulting sward that wild white clover on its own was not enough.

Establishment and Management Good establishment with a very low seed rate is exceptional. There were instances where the standard mixture at 14 lb to the acre met with a very indifferent establishment, giving the mixture an unfavourable reception. Such poor takes were usually traced to bad tilth conditions invariably associated with

late sowing. Timothy seed, being small, requires very shallow sowing, under conditions where there is sufficient soil moisture for germination. Its establishment can be assisted by adequate rolling.

Soil fertility is another factor influencing establishment. Where the organic content of the orchard soil is so low that sward establishment will be doubtful, it is advisable to sow a pioneer mixture of oats and vetches or Italian ryegrass. This can be disced into the ground in preparation for the sowing of a more permanent seeds mixture the following year.

The potash content of orchard soils is usually adequate, but the lime and phosphate status may be low. Although the trees may not need them, these nutrients should be available in sufficient quantity for the establishment of the grasses and clovers.

The most important single factor influencing the botanical composition of these swards has been the management to which they have been subjected. In a grass-clover community the required balance can be achieved by regulating the cutting in relation to the stage of growth of the plants. Controlling the height of the companion grass may be the main aim of the management. If this is so, the selection of a short, slow-growing grass which allows white clover to develop in association with it will eliminate the necessity for close cutting.

In one orchard where the standard timothy-white clover sward and two variants were under observation, an attempt was made to maintain the swards at three growth levels. One treatment was the customary close cutting at two inches above the ground, the second a medium cut at four inches, and the third a cut at six inches. This management was continued for eighteen months—from March 1954 to September 1955. The close cutting produced a relatively patchy sward with little clover, which was markedly affected by prevailing dry conditions last year. The medium cut gave a thicker ground cover, contained much more clover, and was little affected by the lack of rain. The high cut contained still more clover and, though unaffected by the dry season, appeared ragged. Discussion with the grower led to the conclusion that medium cutting was the best type of management and gave the greatest measure of protection to the soil. The latter was moister under this treatment than under the close cut and there were fewer adverse effects from orchard traffic.

In some orchards where a medium-cutting technique had been followed, a lush clover sward has developed and this has depressed the timothy. Firm recommendations for height of cutting cannot be made, but in such cases a slightly closer cut of the lush clover to preserve the balance of grass to clover would have been justified. On the other hand, the absence of a cut earlier in the season may allow the grass to dominate the area to the detriment of the clover constituent. The grass-clover proportions change under varying conditions, so that a close watch has to be kept to regulate the height of the topping and preserve the desired balance.

It has been suggested that any sward other than one kept very close will interfere with moisture requirements at critical times—a circumstance which has created management difficulties. Under dry conditions naturally all plants suffer, but the experience gained in the last few years suggests that the thick grass-clover turf will keep a soil much cooler and thus reduce evaporation from the soil.

WINTER RAPE AS AN OIL SEED CROP

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An examination of the influence of sowing dates on winter survival and yield of the principal varieties of winter rape and winter turnip rape.

WHEN the investigation of oil seed rapes was first started at Oxford in 1947, a review of the results and experience of their cultivation in north-west Europe during the war indicated that spring-sown types of rape were likely to be the most successful under British conditions. It was appreciated that the autumn-sown types were more productive, but there was a seeming disadvantage in that the crop required to be sown during midsummer and therefore did not readily fit into the normal patterns of rotations in southern and eastern England. This conclusion was based on old and new sources of information. In the eighteenth century, when rape was a relatively common crop, the general farming experience was recorded in several books, such as Mortimer's *Art of Husbandry*. In the last decade a number of papers from Germany and the Scandinavian countries have appeared in which recommendations for the right time of sowing have ranged from late June to mid-August.

In 1951, when the main programme on annual rapes was nearing completion and proposals could be made for their cultivation,* the position concerning the autumn-sown biennial types was re-examined. During the intervening years, experience in Sweden had shown that when oil rapes are grown on a large scale there may be a very rapid build-up in the populations of insect pests, but that this danger is less with autumn-sown types. Moreover, there was some indication that some of the modern biennial types were relatively frost-hardy and, in consequence, September sowings might be feasible because of the milder conditions of British winters. Therefore, in the autumn of 1951 a start was made to investigate the influence of sowing date on winter survival and yield of some of the principal varieties of winter rape and winter turnip rapes grown on the Continent.

Early September Sowing For the first trial, in the autumn of 1951, eight varieties of rape and four varieties of turnip rape were sown on September 2, 10, 18 and 29. All varieties emerged quickly and evenly from the first three sowings, but emergence from the last was slow and irregular. Very little growth was made before winter from the final sowing date—especially of the winter rape varieties—but there was no evidence of any winter mortality. By mid-March, plants from the earlier sowings had started to grow, but for the September 29 sowing the regrowth was slightly later and the performance was inferior up to harvest time. Summarized data of the influence of sowing date on both seed pod (siliqua) production and seed yield are given in Table 1. It is evident that delaying the sowing date only begins to have an adverse effect if it is postponed until the second half of the month, while by the end of the month there are very significant reductions in seed yield and siliqua production. In view of

* The Cultivation of Annual Rapes as Oil Seed Crops. E. S. Bunting and G. E. Blackman. *Agriculture*, 1952, 58, 509-13.

Continental experience, it was of interest that these depressions were caused by a serious infestation of pollen beetle on the late-flowering plots.

Table 1
Effects of Sowing Date on Seed Pod Production and Seed Yield of Autumn-sown Varieties of Rape

	Sowing Date				Sowing Date			
	2/9	10/9	18/9	29/9	2/9	10/9	18/9	29/9
	Siliquas per Foot of Drill				Seed Yield (cwt/acre)			
Winter rape varieties ..	682	681	642	367	16.3	16.3	15.5	6.2
Winter turnip rape varieties	830	802	810	598	16.4	16.4	12.5	7.2
Sowing date means	756	735	717	470	16.3	16.3	14.2	6.6

Subsequent trials have confirmed these initial conclusions. Thus the yield data given in Table 2 show that significant reductions in yield may be expected from late September sowings, as compared with early or even mid-September sowings.

Table 2
Influence of Sowing Date on Seed Yield (cwt/acre)

	Expt. 1/52 Sowing Date		Expt. 2/52 Sowing Date		Expt. 1/54 Sowing Date		
	12/9	29/9	19/9	29/9	3/9	10/9	17/9
Winter rape varieties	14.3	8.6	17.8	10.7	14.7	15.1	15.0
Winter turnip rape varieties	9.8	9.1	10.5	7.8	—	—	—
Sowing date means ..	13.1	8.9	12.9	8.7	14.7	15.1	15.0

Preference for Winter Rape In these experiments the proportionate reductions in yield due to late sowing were less for winter turnip rape than for winter rape. This difference in hardiness agrees with the general experience of Continental countries where it has been concluded that the turnip rape varieties are less susceptible to winter killing. It is unlikely, however, that the ability to survive the winter is the only factor concerned, since between 1951 and 1954 there was no evidence of serious winter killing of any variety in these trials. This conclusion was based on detailed counts of plant survival not only in the sowing date experiments but also on adjoining farm crops of Lembke winter rape and Lembke turnip rape. Indeed, even the prolonged cold spell of January-February 1954, when the temperatures remained below freezing (with a minimum of 18 degrees of frost) for fourteen days, had no apparent adverse effects. In the circumstances, it would seem that the winter rape varieties at present available are sufficiently hardy to withstand conditions likely to be met with in this country. If additional experience confirms this conclusion, it is unlikely that winter turnip rape varieties will be commercially important, since the winter rape varieties have a greater capacity for seed production. This difference in productivity between the two types is indicated by the yield results of Tables 1 and 2, and additional evidence is forthcoming from variety trials, of which some selected results are presented in Table 3.

Table 3
Varietal Differences in Seed Productivity of Winter Rape and Winter Turnip Rape

	Yield (cwt/acre)			
	Expt. No.			
	1/51	1/52	2/52	2/54
Winter turnip rape				
Rapido	8.8	8.2	8.6	—
Lembke	17.0	11.4	12.4	—
Weibull's Storrybs	15.5	10.2	—	—
Winter rape				
Lembke	15.9	14.9	17.8	15.5
Matador	17.3	17.7	—	15.7
Tenus	16.4	12.1	—	13.6
Svalöf Late Rape	13.6	12.8	—	12.4
Hambourg	—	14.4	—	14.7

It should be emphasized that neither the levels of seed yield nor the differences between varieties completely reflect performance under farm conditions, because it proved impossible to prevent finches and other small birds from damaging the small area of experiments. Moreover, since the bird population started to build up once the earliest variety was ripening, the later and heavier yielding varieties had perforce to be harvested before they were fully ripe. In consequence, the circumstances tended to favour the earlier turnip rapes. It is considered, however, that the results from the comparative point of view are valid, especially since the conclusions are supported by many of the findings in Sweden.

Varieties Compared Considering first the turnip rape varieties, Rapido, a variety developed at Svalöf, is earlier, shorter strawed and lower yielding than Lembke's winter turnip rape or Weibull's Storrybs, a selection from Lembke. The two latter varieties are believed to have originated from a rape and turnip rape cross, and it is not surprising, therefore, to find that they occupy an intermediate position in earliness between Rapido and the winter rape varieties. Observations on flowering date between 1951 and 1955 have shown that Rapido starts to flower three to eleven days before Lembke and Storrybs. In the rape varieties there is little to choose between the first four listed in Table 3, while Hambourg comes into flower about two days later. Both between years and between sowing dates there are considerable differences in the onset of flowering. For sowings made in the first fortnight of September, Rapido opened the first flowers between March 28 and April 18, while delaying sowing from early to late September retarded flowering by six to seventeen days. The winter rapes taken as a whole were from thirteen to nineteen days later than Rapido.

The German winter rape variety, Lembke, was predominant in Western Europe for many years, and only in areas where it did not prove sufficiently winter hardy was a substitute sought. Two selections from Lembke have been marketed in Sweden—Matador, originating from Svalöf, and, more recently, Margo produced by Weibull's. In Sweden, Matador is reported to have outyielded Lembke by about 8 per cent and the results in Table 3 are in agreement. So far, Margo has not been tested in replicated trials at Oxford, but judged by observation plots, it appears to have similar characteristics to Matador.

WINTER RAPE AS AN OIL SEED CROP

Svalöf Late Rape was a hardy variety originally selected in the early 1920s; it has now been superseded by Tenus. The superiority in winter hardiness claimed for Tenus, as compared with Lembke selections, is outweighed in the milder British climate by the lower level of seed production. Both Dutch and French selections of Hambourg rape have been tried; they are less productive than the Lembke types but may have a potential value for breeding short-strawed varieties should the need arise. The British forage rape variety, Essex dwarf, was included in the variety trials of 1954 and 1955. The commercial samples of seed produced very mixed populations of plants differing widely in height, earliness and flower colour. It is concluded that for oilseed production this variety is considerably inferior to the better Continental varieties.

Cultural Points The general cultural procedure for rape presents no difficulties. Experiments on sowing rate have indicated that a rate of 6-8 lb per acre is desirable in drill rows 16-18 inches apart. Preliminary experiments suggest that higher yields may result from narrower (that is, 7 to 8-inch) drill widths, provided inter-row cultivation is not demanded for killing weeds. Rapes require a high nutrient status of the soil combined with an adequate level of calcium. Successful crops can be grown on light to medium soils, but relatively heavy soils (provided they drain freely and have a good content of organic matter) seem to be the best. Rows more than 18 inches apart are unnecessary and may lead to reduced yields. The crop responds well to heavy nitrogen manuring (up to 60-70 lb N per acre), including nitrogen added as a top dressing in early spring. All rape seed varieties flower over a long period and the tendency for siliquas to shatter when the seed is fully ripe may lead to crop losses if harvesting is delayed. Rape seed may be combine harvested directly, but to avoid seed losses the best method is undoubtedly to cut and windrow just before the crop is fully ripe and thresh a few days later with a combine fitted with a pick-up attachment.

Although, in contrast to experiences with spring-sown varieties, damage by Flea beetle to germinating seedlings of winter rape is rare, it is nevertheless advisable to be prepared with control measures should the need arise.

Reference has already been made to bird attack of the experimental plots during the ripening phase, but on a farm scale the increases in the size of the area and the fact that only a single variety will be grown, with the consequent smaller risk of a cumulative population of birds, should permit yields of up to 30 cwt per acre. So far, experience in East Anglia suggests that pigeon attack during the winter months is a greater problem, and that in areas where there are high winter densities of pigeons large blocks should be sown and steps taken to keep the birds off the fields.

The oil content of winter rape seed is high (about 45-48 per cent) and the seed should command a higher price than that obtained from annual spring-sown varieties with oil contents of 38-40 per cent. There is a steady but limited industrial demand for rape oil in Britain. Crude rape oil is used to produce a rubber substitute and, mixed with mineral oils, is a valuable lubricant. The refined oil is also employed for specific burning and lubricating purposes and is a basic material for the manufacture of rubber tyres and other allied products. One firm alone is processing annually 9,000 tons of rape seed, of which more than 7,000 tons have to be imported. The home production of winter rape seed at a competitive price would remove the necessity of imports to the benefit of both farming and urban industry.

SULPHURIC ACID FOR THE CONTROL OF WEEDS IN KALE

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National Agricultural Advisory Service, South-Western Province

Sulphuric acid sprays normally give good control without risk of toxic residues to stock, but some farmers are reluctant to use them against weeds in kale because of the risk to operators.

SO far as I am aware, the earliest work on the control of weeds in kale and rape by sulphuric acid was done by J. R. Stubbs, working in Gloucestershire, who had noticed the survival of self-sown kale plants in a field of corn which had been sprayed with this herbicide.* Since that time, many crops of marrowstem and thousandhead kale and of forage rape have been treated with acid successfully. Indeed, a country-wide survey, carried out through the N.A.A.S. by E. I. Prytherch and myself, showed that the technique had been tried with success in almost all parts of England and Wales.

Unfortunately, widely differing points of view are held as to the worth of this practice. Whilst some farmers will not use it or allow it to be used on their farms, because of its potential danger to the operator, others are enthusiastic about it. Then, on the drier, eastern side of the country, the kale crops can be kept weed-free, except in the most difficult season, with normal pre-sowing, and subsequent inter-row, cultivations. Our survey showed that it was only in the wetter parts of the country—that is, the north-west, Wales, and the south-west—that the difficulties of eliminating weeds were such as to over-ride the objections to the use of acid. In Wiltshire, for example, about 300 acres of kale are now sprayed every year by one contractor, and in Dorset the position is similar. Undoubtedly, many more acres would be dealt with in these and other counties if facilities were available.

Contractors who have experience of using acid, or are willing to acquire the experience, are the best means of extending its use. Some farmers possess their own acid-resisting spraying machines, and a few have taken risks with their ordinary low-volume machines, but the latter is a practice which, quite apart from its adverse effect on the machine, is to be discouraged in the present state of our knowledge.

The three weeds giving most trouble in farm brassicas are yellow charlock (*Brassica sinapis*), redshank (redlash, willow-weed, etc.—*Polygonum persicaria*) and fat-hen (muckweed, etc.—*Chenopodium alba*). Charlock is the easiest to deal with, redshank is intermediate, and fat-hen the most resistant to acid. The practice so far has been to spray infested crops as a last resort—when they would otherwise have had to be ploughed in. At that stage, there is usually a canopy of relatively mature weed which would be expected to offer the crop some protection from the acid. About 100 gallons of spray per acre, containing, say, 10 gallons of brown oil of vitriol (or its equivalent of pure acid) for yellow charlock, 12½ gallons for redshank, and 15 gallons for fat-hen, is normally used. As with other weed-killers, the aim is to give the crop ascendancy over the weeds, rather than to achieve a complete kill of weeds, which might result in increased spray damage to the crop. For this reason, in the absence of reliable experimental evidence, I do

* Winter Grazing for Dairy Cows. J. R. Stubbs. *Agriculture*, 1948, **55**, 369-75.

not favour the addition of a wetter (which would increase the adherence of the spray to both crop and weeds).

The spraying invariably checks the growth of the crop—least if it is in a "growthy" condition, and most if drought or other adverse factors have been operating—but no case has ever been brought to our notice of the crop being ruined by the acid (without a wetter). Crops often look very sick just after spraying, and the check may be apparent for a month afterwards, but the effect is minimized if 3 cwt per acre sulphate of ammonia (or its equivalent) is given immediately after treatment. Failure of the treatment has only been known to us where a resistant or mature weed has been sprayed during a period of drought, when all weeds tend to "harden-up". In these circumstances the crop has had to be resprayed after rain to achieve the desired effect. So much, briefly, for a technique which has been built up largely from trial and error on a field scale.

When to Spray A limited amount of experimental work is leading us to question whether, in fact, the "weed-canopy" stage is the best time for the treatment. Spraying kale at various stages of growth (without a wetter) has shown that the crop can survive the spray at any time, except that of the cotyledon or seedling growth. Morover, a better kill of weeds is obtained with lower strengths of acid before any real competition for plant nutrients has occurred. What we do not know for certain, until current experiments have been completed, is whether the check to the kale crop is less by spraying when there are two to three leaves or when the crop is, say, 12-18 inches high. From the point of view of weed control, there does seem to be an intermediate stage when the acid cuts off the exposed growth and regrowth takes place from below. Even if we are able to prove that early spraying is the more profitable, this is likely to be adopted only by those who have a weed problem year after year. The farmer who experiences real trouble only occasionally is likely to try cultivations first, and spraying as a last resort.

The other aspect on which further investigation is needed is that of low-volume spraying. Spraying at low volume (on occasions with neat brown oil of vitriol) has sometimes been successful and sometimes unsuccessful. It is certainly a practice which we should advise against until more is known about it. Quite apart from any other consideration, greater damage appears to be done to the crop than is the case with high-volume spraying, possibly as a result of the small droplets clinging to the kale instead of, as in high-volume spraying, the larger droplets tending to run off the leaf.

Search for Alternatives Undoubtedly, there is a very great need for another chemical which can be used in farm brassicas without risk to those who have to handle it, or to domestic and wild animals. Alternatives to sulphuric acid have been and are still being tried. One of these can be highly dangerous to man and animals; the efficiency of others for the control of weeds in brassicas has yet to be proved. In the meantime, acid will certainly do the job, but it is better handled by those who have had experience with it, or who are prepared to exercise the greatest caution to avoid accidents. For example, when diluting it is essential to add the acid to the water, never the reverse. Fortunately, its dangers are restricted to mixing, handling, and spraying—there is no lingering toxic residue, as with some other spraying materials.

APPLES IN DENMARK AND SWEDEN

F. A. ROACH, B.Sc.

National Agricultural Advisory Service, South-Western Province

There has been a marked increase in the apple production of both Denmark and Sweden since the war. Mr. Roach, who visited the main apple-growing centres recently, here discusses the trends in orchard management, marketing methods and research in the two countries.

ALTHOUGH the fact is not generally appreciated in this country, production of both top and soft fruits is of considerable importance in both Denmark and Sweden. Their total acreage of apples falls far below that of Great Britain but, in proportion to her population, Denmark grows more apples per head than this country, and an increasingly important export trade is being built up. Sweden is not yet self-supporting in this fruit, but the many orchards which have been planted in recent years should go a long way towards making the country independent of imports.

The climate in the main fruit-growing islands of Denmark, Funen and Zealand, is very similar to that of Scania, the southernmost province of Sweden, where 75 per cent of that country's commercial fruit farms are situated. Annual rainfall varies from rather under 20 inches in the drier areas to 30 inches or more. Compared with the apple-growing areas of Britain, the spring is a little drier, but more rain falls in late summer and early autumn. Average winter temperatures are considerably lower than in the south of England and, in severe winters, the trees may suffer injury. The temperature rises rapidly in May and the average summer temperatures are similar to those in the south-west of England, although, owing to the geographical situation of Scandinavia, day length in summer is rather longer than in Britain.

There are a few large apple orchards of up to 100 acres or more in Denmark and Sweden, but the average size of fruit holdings, particularly in Denmark, is small. An extreme illustration of this is seen in an apple marketing co-operative near Holbaek in North Zealand, which has 89 members with a combined fruit area of only 250 acres. These very small holdings are often worked by their owners as a part-time occupation.

Varieties and Orchard Management Much of the apple acreage in these two countries has been planted since the war, and new orchards consist mainly of dessert varieties. The principal variety is our own Cox's Orange, which accounts for about 25 per cent of the trees in Swedish orchards and is also predominant in Denmark.

Ingrid Marie, a Cox seedling found growing in a garden near Odense and brought into commercial use in 1936, is now widely planted in Denmark and Sweden and is arousing interest in other countries. The fruit is similar in shape to Cox, is well coloured, and is in season until about January. The flavour of Ingrid Marie is inferior to Cox, but the variety is a very much better cropper and is less subject to disease.

The main cooking apple in Denmark is Belle de Boskoop, of which a red sport is sometimes planted. Few cooking apples are grown in Sweden and it seems there is little demand there for such fruit. Bramley's Seedling is not popular in Scandinavia, since the trees are very prone to winter injury.

Other English varieties grown in both countries are Laxton's Superb, Lord Lambourne, James Grieve and Cox's Pomona, the latter being popular for autumn dessert. Gravenstein is much grown for early eating. Of American varieties, Jonathan was previously fairly widely planted but is losing favour since it has been found that the size of fruit becomes small as the trees mature. Golden Delicious is grown successfully in Denmark and is found to respond well to thinning with alpha-naphthalene acetic acid. Cortland is being tried but is very susceptible to Apple Canker.

Most apple orchards in Denmark and Sweden are planted with bush trees worked on seedling and Malling IV rootstocks. A common arrangement is to use seedling stocks for the permanent trees at about 24 feet square, with trees on M.IV as fillers 12 feet apart. As a consequence of this close planting, many of the orchards seem to be in need of thinning, when compared with the wider spaced plantations at present favoured in our country. Trees on M.IV crop heavily early in their life, and the poor root holding usually associated with this rootstock does not appear to be of major importance.

Pruning is usually fairly light, and generous use is made of fertilizers. Applications of nitrogenous fertilizers vary from 5 to as much as 10 cwt to the acre; in addition, many growers also apply nitrogen as 0.2 per cent urea in several of the scab sprays. Potassic fertilizers are used at about 2 cwt per acre, and magnesium deficiency is combated by sprays of magnesium sulphate.

Very few modern apple orchards are grassed down in either Denmark or Sweden: in both countries trials on the use of swards compared with clean cultivations have generally shown the detrimental effect of grass on the trees, even when high dressings of nitrogen have been given. No doubt the fact that the rainfall is at its lowest in spring and early summer while the temperature rises fairly rapidly during these months, results in severe competition between the trees and the grass at a vital period.

The level of pest and disease control in most of the commercial orchards I visited was very high. Much of the spraying on the smaller holdings is done by hand-lances, but on larger farms automatic machines are used. Winter washing has largely been replaced by spring applications of insecticides, and both parathion and systemic phosphorous materials are applied extensively. For Apple Scab control, a great variety of chemicals are used, including copper and mercury compounds, captan and the di-thiocarbamates: lime sulphur has little place in the spraying programmes. Applications of ziram, put on in late summer, are becoming increasingly popular, with apparently good results, to control late attacks of scab and to reduce storage rots.

Co-operative Marketing Denmark is, of course, noted for the co-operative marketing of her agricultural products, and it is therefore natural that this system should have been extended to horticultural produce. The first general co-operative for marketing such produce was started at Odense in 1929 and today has 1,300 grower-members. These members must send all their fruit and vegetables for sale through the market, but not necessarily their flowers. Ungraded produce can be delivered to the market for grading and packing, and all sales are conducted by Dutch auction. Members are charged 8 per cent commission on sales and may receive 2-2½ per cent back as a bonus at the end of the year.

Apart from general co-operatives, there are others established mainly for handling the apple crop. There are about eight of these in various parts of Denmark, and similar organizations exist in Sweden. Most of these fruit

Ingrid Marie dessert apple—a Danish seedling from Cox popular in Denmark and Sweden.

Photos: *F. A. Roach*

Orchard of Cox and Ingrid Marie apples planted at Blangstedgaard Fruit Experiment Station in 1949.

Photo: *C. W. Rowell*

The park is once more back to grass.

Photo: *H. Wheeler*

New pasture on the Holkham marshes. The trees in the background were killed in the 1953 sea floods

Holkham Article on pp. 29-33)

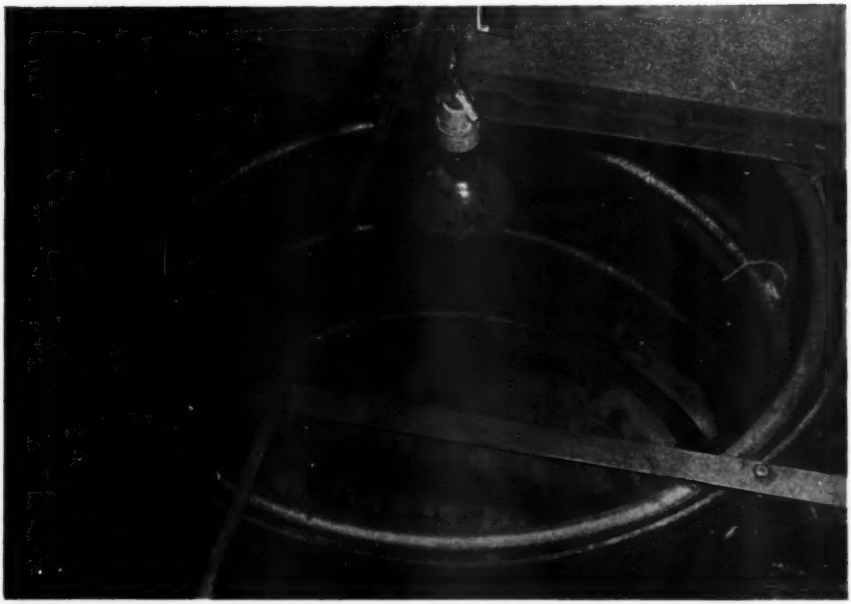
Photo: *E. E. Swain*

The Great Barn at Holkham in which the famous shearings were held. It is now used as a grain store.

Photo: *H. Wheeler*

The estate sawmill. Most of the timber required on the estate is home-grown.

Farrowings in the Roundhouse (Article on pp. 27-8)



A roundhouse made of hardboard bolted to a light iron framework.

Photos: *R. James Colley*

In only one spot can the sow lie comfortably. The piglets thus have the maximum degree of safety.

marketing co-operatives have been started since the war, and in Denmark, as the result of the war-time occupation, some financial assistance has been obtainable from Marshall Aid.

An interesting point about most of these co-operatives is the small acreage of individual members. As previously mentioned, the Hafex co-operative near Holbaek in North Zealand has 89 members, with a total of 250 acres of top fruit; the Neff co-operative to the north of Copenhagen, has 45 members with 625 acres; and a co-operative apple packing station in southern Sweden has 40 members, with a total of 500 acres of fruit.

The new packing stations are generally well equipped with cold and gas stores and make use of modern labour-saving devices such as fork-lift trucks and pallets. A 40 lb wooden box is the usual container for marketing apples, the cost of which, plus packing charges, seems to be about 5*s*. About half the output of most Danish packing-houses is exported, the higher grades going to Great Britain, Finland, Norway and Sweden, and the lower grades to East Germany, where, owing to the apparent general shortage of apples, they are very ready to buy these grades on a barter basis. As a result of this barter, some Danish co-operatives have experienced financial difficulties, since, in exchange for their fruit, they have received unsuitable goods which are often difficult to sell.

The main apple varieties exported from Denmark are Gravenstein, Cox, Ingrid Marie and Boskoop. Since Sweden is still an importer of apples, most growers in that country try to market their crops in the autumn and early winter before imports begin to arrive.

Danish Research There are four state horticultural experiment stations in Denmark, one of which (Blangstedgaard, near Odense) is principally concerned with work on fruit trees, irrigation and storage. This station was established in 1915 and covers 155 acres. The general policy underlying all experimental work in Denmark has been to "investigate problems encountered in the daily work of the soil cultivator, whose main interest is how the greatest possible profitable yield may be obtained". Much of the work thus has immediate practical application, rather than the more fundamental approach common to our own research stations.

At Blangstedgaard, several trials on the manuring of apples are growing on land which has received the same manurial treatment since 1922. One trial, planted in 1928, has shown no difference between the growth and yields of apple trees receiving annual dressings of farmyard manure alone, and trees receiving the same nutrition in the form of fertilizers. Other trials have shown no response to dressings of nitrogen in the cropping of apples grown under clean cultivation, though the trees receiving no nitrogen consistently have paler foliage than the others. The result, however, is very different where trees are grown in grass, when the competition of the latter for nitrogen is severe. This lack of response to nitrogen by apples under clean cultivation is particularly interesting in view of the large quantities of nitrogenous fertilizers used by most Danish apple growers.

In a trial on the use of magnesium with apples, trees worked on M.I rootstock growing on magnesium-deficient soil are very much dwarfed compared with those on M.II, M.XII and M.XVI stocks. Another investigation at Blangstedgaard concerns the leaching of nutrients from apple leaves during wet weather. It has been found that both potassium and certain organic compounds are readily leached during heavy showers, and it is suggested that additional applications of potash, or perhaps orchard spraying with this nutrient, may be advisable in wet summers. Trials with apples

pruned by the regulated and renewal systems have given approximately equal yields; both systems have proved much better than either long or short spur pruning.

Swedish Research The main horticultural experiment institute in Sweden is at Alnarp, in Scania, where some 38 acres are devoted to experiments on fruit. This station was started in 1938 to take over work previously done there by the Alnarp Gardens and the Swedish Pomology Society. Trials on the use of fertilizers, pruning and propagation investigations, and the testing of varieties are all being carried out at Alnarp. Apart from the main institute, there are six sub-stations established in different parts of the country where local problems can be investigated. In addition, there are some fifteen permanent experiment fields.

The breeding of new varieties of fruit in Sweden is done at the Balsgard Fruit Breeding Institute near Kristianstad, in north-east Scania, one of the country's most important fruit-growing areas. This institute, which was started in 1941 on the joint initiative of Swedish scientists and fruit-growers, is the only one of its kind in Scandinavia. Most fruit varieties grown in Sweden were introduced from other countries and are often not well suited to the Swedish climate. A pressing need is for apples to combine winter hardiness with other desirable qualities. Considerable efforts have been centred on the collection and production of tetraploid apples and pears to be crossed with diploids, in the hope that this will result in the production of useful triploid forms. There are now some 200 such tetraploid seedlings from Ribston, Boskoop, Blenheim and Cox's Orange apples and from various pears growing at the Institute. Cold resistance of breeding material is tested in the laboratory, and artificial freezing trials have shown surprisingly good agreement with field observations. Breeding of rootstocks has already resulted in the introduction of the apple rootstock A 2, now being tested on a wide scale as a winter-hardy type.

Since 1944, X-rays have been used at Balsgard for the creation of mutations. More recently, injection of radio-active isotopes into buds, branches or stems of trees, and *gamma*-irradiation of scions by the Cobalt 60 source at the Institute, have been used in the production of new plants. This use of modern equipment and methods may be indicative of the future development of the apple-growing industry in both Denmark and Sweden, where growers seem ready to adopt modern ideas in the production and marketing of their crops.

FARROWINGS IN THE ROUNDHOUSE

SIX MONTHS' EXPERIENCE WITH A ROUNDHOUSE ON THE RUAKURA PATTERN

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IN Spring 1955, becoming interested in a report of the novel type of circular pighouse devised by Mr. D. M. Smith of the New Zealand Department of Agriculture, at their Ruakura Research Station,* we built one at Writtle. It was made of hardboard bolted to a light iron framework. Apart from structural detail, this differs from his principles only slightly. Our model was built in sections such as we could get through the door of our pre-war, conventional-type Danish pig-house (with pens railed and equipped for farrowing), where we assembled it, bolting it to the floor over the hollow-bed area within a normal square pen with dunging passage.

After six months' use (July 1955–January 1956) we can compare rearing figures of 9 litters (6 Essex, 3 Large White) farrowed in the roundhouse, with (a) 13 litters farrowed over the same period in the unmodified pens of the house; and (b) the previous litters from the same 9 sows born in the previous six months in unmodified pens.

Litter Averages (in round figures)

	Births			Deaths		Live Wt. at 3 weeks	Death Rate	
	Dead	Live	Culls	In R'house	Addit. to 3 weeks		In R'house	At 3 weeks*
						lb	*per cent*	
Group I 9 sows in roundhouse, July 25-Jan. 11	1.4	11.0	0.6	0.6	0.7	11.0	5.3	11.7
Group II 13 sows in normal pens over same period	1.2	11.0	0.1	not applic-able	3.1	11.9	not applic-able	22.3
Group III Original 9 sows in normal pens	1.6	11.6	0.9	not applic-able	1.6	12.5	not applic-able	15.6

* Excluding culls.

In each comparison, aside from the relevant question of roundhouse versus square pen, there remains, unfortunately, a second major variable. In the first, although near-related and of very similar stamp, two different batches of sows were involved. In the second, there were two different six monthly periods, with whatever unspecified differences of weather, manage-

* *New Zealand Journal of Agriculture.* 89, No. 3. September 15, 1954. Wellington.

ment details, and sources of food they involved. The events compared are few and variations occur by discrete steps of death by death. Litters varied from 5 to 17 live births (plus the born dead). Two were gilt litters, and most ranged from third to seventh litter, with a veteran doing her thirteenth. Ignoring culls, deaths per litter ranged from 0 to 8 crushed. Thus variances are high and differences between means of statistical significance were here neither expected nor reached.

Thus we do not place too much weight on the averaged figures of these three groups presented below, which, on the face of it, and consistently, indicate that rearing losses in the neo-Ruakura house are substantially lower than in the normal pens.

Comparing, at three weeks, the roundhouse litters with their unselected contemporaries in square pens, losses were lower by about 50 per cent. Our roundhouse (including estimate for labour) has cost just over £38. If this has in fact saved us, on the above reckoning, 10 weaners at, say, £5 each, it shows a good dividend on the first six months' use.

Comparing present roundhouse families with previous litters by the same sows in normal pens, and accepting all deaths to three weeks in the present litters, the death rate fell from 15.6 per cent to 11.7 per cent. It seems not unfair, however, to eliminate from Group I, four piglets killed by a sow as a result of too early removal from the pen, and two lost by a second sow which became ill and died of metritis before her brood were 18 days old. That comparison would then read 5.3 per cent as against 15.6 per cent, or a reduction in the death rate of over 60 per cent.

The sows went into the roundhouse without selection, purely on the accident of next due to farrow.

In view of the reserve and wariness with which our herdsman first regarded this new device, we left him a wide discretion upon the general instruction of "put in seven to ten days before, and leave for seven to ten days after farrowing". After two litters, there was no doubt of his enthusiasm; he even demanded more roundhouses than we were ready to agree. Our herd tending to outgrow its quarters, and a rush of farrowings occurring in the late summer, the herdsman moved sows in and out at much shorter order. Two, indeed, farrowed upon their day of entry, most had only three, and none as much as seven days to settle down, but this seems to have done them little harm, as all took easily and happily to their round pen. Only four remained a week or more after farrowing, and several stayed only three days, to which we attribute some loss. The average time the sows were held in the roundhouse in fact worked out at 3.2 days before, and 6.5 days after farrowing.

We publish these preliminary figures merely to encourage and reassure others who may be thinking about such a house, so that a fuller judgment may the quicker be reached as to the value of this promising device. For ourselves, while unchallengeable proof cannot yet be claimed, we have been greatly encouraged to continue the experiment and try further modifications and models. With less pressure of farrowings, more experience, and improved routine, we feel more noteworthy gains could be made.

I am indebted to my colleague Mr. R. J. Colley, B.Sc., for the photographs appearing on page iv of the art inset.

THE STORY OF HOLKHAM

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Coke of Norfolk's farming of the sandy wastes of Holkham is an epic in British agriculture, and the fine tradition which he bequeathed has been honoured to this day.

THERE cannot be many estates in Britain where the fashioning of farms out of heath and waste can be traced step by step. That this is possible at Holkham may be because the land was so inherently poor that nobody thought it worth improvement until the first Earl of Leicester (first creation) took it in hand. Thomas Coke, as he then was, succeeded to the Holkham property in 1707, while still a boy. He was finishing his education abroad when he had the idea of building a palace for himself upon his property. It was a curious choice, for a more unpromising site would have been difficult to find. What is now fertile land with magnificent timber was at that time described as little better than a desert; a bleak country, scantily and primitively cultivated, with no wheat and no cows. It was in fact little more than a sheep walk, carrying a flock of Norfolk sheep (a breed which is now extinct). The big house was not started until 1734, but meanwhile the park had been enclosed with a paled fence and shelter-belts and woodland clumps had been planted. The Earl's widow completed the building the year after his death, and over the doorway the following inscription was placed:

> This seat, on an open barren estate was planned,
> planted, built, decorated and inhabited ye middle
> of ye eighteenth Century
> By Thomas Coke, Earl of Leicester

In 1776 the estate passed to Thomas William Coke, the Countess's great-nephew. He was created Earl of Leicester (second creation) in 1837. He is remembered by agriculturists the world over as Coke of Norfolk.

Fertility out of Wilderness When Coke of Norfolk came into the property it covered some 37,000 acres, the larger part of which was centred around Holkham and was still, in spite of his great-uncle's efforts, sparsely timbered and scantily cultivated. No wheat or dairy stock was produced on any of the farms. The district was still little better than a rabbit warren. Indeed, witty old Lady Townshend told Coke's young bride that all she would see at Holkham would be a blade of grass and two rabbits fighting over it—a saying which has been borrowed from time to time to describe other rubbishy land. Coke had, therefore, from the farming point of view, an opportunity of building from the foundations, and how well he did it is now one of the epics of our farming history.

Coke was a pioneer in many fields; his famous sheep shearings were surely the forerunner of A.L.S. Estate Walks; he gave his tenants security of tenure long before the Agricultural Holdings Acts came on the Statute Book; and he built up fertility by ley farming long before Sir George Stapledon preached that gospel. Coke not only went in for ley farming but he also developed selected strains of indigenous grasses, mainly cocksfoot. Children were paid to collect the seeds, which were then sown in trial beds and the selected plants "inoculated" into clean land.

In many other directions, too, he blazed the trail in good farm management, for he introduced drilling roots in his part of Norfolk as early as 1810, he marled extensively, and it is said that it was he who converted Norfolk into a wheat-growing county. A clause in his tenancy agreement stipulated that "the tenant should adhere and conform to the course of cropping all his arable land under six shifts, of equal portions, of which one shall be turnips, or vetches, fed off with sheep; two other shifts in grass seeds (which shall not be broken up till the same shall have lain two years); one other shift in wheat, and the remaining shifts with lent grain". Equally Coke gave a lead in good estate management, for he built many new homesteads and farm cottages.

Throughout ensuing generations his policy of encouraging good farming among the tenants has been continued, and by 1932, when the Land Utilization Survey was made, practically the whole of the estate was under the plough, including half of the park; there was no waste land of any kind. During the war a further 300 acres of the park was brought under the plough. This now needs a rest after a succession of wheat crops, and every year more of it is being laid down to grass. It is interesting to compare the newly reseeded pasture with the old unimproved sward of the unbroken land which has carried the deer—it stands out vividly green, with the cattle knee-deep in grass. The seed mixture used was:

	lb
Italian ryegrass	6
Perennial ryegrass	6
Perennial ryegrass (N.Z. Mother)	8
S.23 perennial ryegrass	4
S.26 cocksfoot	6
Danish cocksfoot	4
Canadian alsike	2
Trefoil	2
S.100 white clover	1
Kent wild white clover	½

A dressing of 2 tons ground chalk per acre was given before reseeding, which was done without a cover crop.

At the beginning of Coke's regime the sheep were described as having backs as narrow as rabbits. Coke not only improved the quality but brought the size of the flock up to 2,500. A herd of Shorthorns was installed, probably because Robert Bakewell became Coke's mentor and taught him how to judge a beast. Incidentally, it was said of Bakewell that "his animals were too dear to buy and too fat for anybody to eat", so that they would not have done for the present-day market either. The Shorthorns were later replaced by South Devons.

Now that the park is going back to grass, the head of cattle is being built up again on the home farm and quality beef is being aimed at. In the old days, the oxen were often kept until they were seven years old; not until then were they considered ready for the butcher! There is a plaster cast in the Hall showing a "model" joint of mutton with fat four inches thick. We have travelled a long way since then, and the present policy at Holkham is to put purchased Aberdeen-Angus heifers to a Hereford bull.

Land won from the Sea Although local opinion in the early days considered the sandy heaths as hardly worth farming, there seemed to be a good deal of interest in winning the saltings and marshes from the North Sea. As long ago as 1660, a John Coke obtained a royal grant of 360 acres which he enclosed with a sea wall and reclaimed. Apparently the royal revenue was largely made up of the sale of grants of this kind

by the King to his subjects, and another 497 acres adjoining were also reclaimed about this time in the same way. The first Earl (first creation) reclaimed 400 acres more in 1772, and the second Earl (second creation) reclaimed an additional 580 acres in 1859. A further 386 acres was bought in 1922, and the total area of reclaimed marsh is now 2,200 acres. The whole of this area was flooded in 1953 when the North Sea broke in all along the east coast from Lincolnshire to Essex. Six hundred sheep and 200 cattle were drowned in this disaster, but the whole of the land is now back to crops and grass, although for weeks it was covered twice a day by the tides.

For the further protection of this salvaged land, the second Earl decided in 1853 to try to anchor the constantly moving sand dunes along the coast line by planting them with pines. Corsican pine (*Pinus laricio*) proved particularly successful, and it seems as if the Holkham Estate possesses a particularly "seaworthy" strain. These pines have consistently regenerated, and there is now a stretch five miles long, strengthening and beautifying the coast line. Not only do they fix the dunes but, by catching and holding the wind-blown sand from the foreshore, the dunes actually spread out to make a kind of reverse invasion of the sea, so that new land is steadily being built up. Unfortunately, the 1953 floods drowned some hundred acres of the trees. These are being felled and seed from other trees untouched by the flood is now being gathered and sown on the affected flood areas. The Corsican pine readily regenerates in suitable areas. The lop and top from the dead trees has been left *in situ*, and buckthorn and privet are planted to give shelter from the east wind before the pine tree seed is sown.

Forestry Round about 1730, the gorse and scrub were cleared from the park and tree planting began. An avenue of evergreen oak (*Ilex*) was planted with other trees in the park. The early growth of the oaks must have been slow and disappointing in this sandy unfertile soil, but the avenue is now magnificent and probably unique. The forestry in the park has, from its inception, been almost entirely for amenity purposes, and little regard has been paid to the financial aspect. Nevertheless, during the war, when heavy inroads were made on the estate trees, three-quarters of a million cubic feet of timber was taken. This was done with discretion, however, and the parkland is still well timbered with many beautiful trees, and the avenues are unspoiled. There are now about 1,200 acres of woodland, mostly in the form of shelter-belts. In almost every case the plantations are of mixed hard woods (oak, ash, beech, chestnut, etc.) with some Scots pines and other conifers.

An unusual feature of the estate is the frequent use of evergreen oak—planted perhaps because of their beauty and suitability to the climate, but more probably because of their value to the deer and other game.

Homesteads The generous provision of buildings by previous Lords Leicester makes it unnecessary to put up many new buildings. In fact, the problem is usually how best to convert them to modern uses, otherwise they may become an embarrassment: for example, on one farm there is a cowhouse for 47 which is no longer needed because the farm has adopted the milking parlour system. Large stables have become redundant, but many of them have been adapted as piggeries. The Great Barn in which the "shearings" used to be held has been converted to a corn store, and many tenant farmers on the estate are similarly putting their large barns to this use. When new buildings are needed the estate will provide them, charging interest on the cost; but the tenants usually prefer to bear or share the expense so as to reduce the interest charge.

The estate is almost unique in that it is practically self-supporting as regards the maintenance of buildings. This has been almost forced upon it because, as a result of the individual interest shown by past owners, standard sizes have been disregarded, and in consequence all windows and doors have to be specially made. Even the bricks are not of the standard size and have to be made on the estate. Most of the timber required is home-grown and is converted on the estate sawbench. A pressure creosoting plant ensures its long life. Similarly, the road material required to maintain the 19 miles of drives in the park, all of which are kept in good condition, is quarried on the estate. The estate also possesses its own nursery, where the young tree requirements are grown from seed.

The resident maintenance staff for the Home Estate numbers about 25, the cost of which is a very heavy charge on the revenue. Contractors are employed on the other farms.

Tenancies The tenants are the backbone of any agricultural estate, and Coke of Norfolk obviously began on the right foot when he set to work to gain their confidence and put them on the right road. He gave them long leases, built farmhouses, cottages and buildings, and set them an example in efficiency and energy. It is true that he raised the rents—he could hardly do less, for his farms had been let at only 1*s.* 6*d.* an acre. Knowing how badly stock was needed on this hungry land, he was always willing to build an extra yard and cattle shed for his tenants free of expense. In this way prosperity was built up. In 1776, the population of Holkham was only 200 and the rent roll of the estate £2,200, but by 1818, during a time of unparalleled distress and depression in England, the rent roll had increased to £20,000 and the number of inhabitants had gone up three times (and even then they were short of hands). In 1773, the poor-house was always over-full—by 1818 it had been pulled down. There have been no "absentee landlords" since Coke's day. It is a testimonial to the Leicester management that they are able to "breed their own tenants", and many of the Holkham farms have been in the same family for over 300 years. There is every evidence of prosperity on the estate, and the farming depression between the wars was weathered without casualties.

Second in importance to the owner in the smooth running of the estate comes the steward, in which capacity Coke of Norfolk first came to Holkham in 1775. Coke himself appointed as his land agent "Handsome" Francis Blackie, who was responsible for running the estate until he retired sixteen years later. It is said that he was "adored by the farmers and trusted by Coke", who was full of admiration for his ability, integrity and zeal. The present resident agent of Holkham is Mr. F. S. Turner, who has given a lifetime of service to his charge and carried on a long tradition of a "happy estate".

The 33,000 acres which now form the Holkham Estate consist of 126 farms, of which 56 are over 50 acres, and 33 over 500 acres.

Game No account of Holkham would be complete without telling the game story. In days gone by the kills were quite colossal: for example, in 1924 the game book records the bag as 8,527 partridges, 4,396 pheasants, 4,511 hares and 788 "various". On one famous occasion a guest killed two woodcock with one shot, a feat which has been immortalized in marble, as testified in the Hall.

Such bags are no longer the order of the day. During the last few years partridges have greatly diminished in numbers, and hares have practically

disappeared. Whether this falling off is due to chemical farming, mechanized farming or some other cause is a matter for speculation. Rabbits have always been abominated at Holkham. The present owner needed no urging to respond to the Ministry's appeal to polish off the survivors from myxomatosis and a reward is offered for every clean rabbit brought to the estate office.

The estate is run on business lines, and perhaps the only extravagance is the retention of a large herd of fallow deer, although the numbers are reckoned to be only half the former size. Thousands of people visit the park during the year, and the deer add so much to the beauty of the landscape and give so much pleasure that one cannot begrudge the grass they eat. The large flock of resident Canadian geese are another feature of the park; they add to its interest and help to keep the grass green.

FORTHCOMING AGRICULTURAL SHOWS

DATE	SHOW	LOCATION
May		
8-9	**Oxfordshire**	Oxford Airport
10-12	**Royal Windsor Horse**	Home Park, Windsor
16-17	**Shropshire and West Midland**	Shrewsbury
17	**Hertfordshire**	St. Albans
21	**North Somerset**	Ashton Court, near Bristol
21	**Surrey**	Gatton Park, Reigate
21-22	**Warwickshire**	Wellesbourne Aerodrome, Warwick
23-26	**Royal Ulster**	Balmoral, Belfast
24-26	**Devon**	Exeter
25-26	**Cambridgeshire and Isle of Ely**	Ely
30-June 2	**BATH AND WEST AND SOUTHERN COUNTIES**	Cardiff

These dates are subject to revision or even cancellation.

New Spraying Guide

A simple crop spraying guide, designed to assist farmers in choosing the correct time and method of controlling the more common weeds, insects and fungi on the farm, has been published by Fisons Pest Control Ltd., Bourn, Cambridge.

The guide takes the form of a central panel giving crop-by-crop and pest-by-pest treatment, surrounded by coloured illustrations of twenty-one important farm weeds (in both the early and flowering stages) and six common insect pests.

GRAIN ON THE FARM

F. W. HOLDER, B.A.(Arch.), F.R.I.B.A.

and

N. K. GREEN, B.Sc.(Agric.), F.L.A.S., A.R.I.C.S.

Agricultural Land Service

The combine harvester brings in its train the need for adequate drying facilities and storage space. There are a number of different grain driers and storage containers on the market, but the choice will depend largely on the amount of grain to be handled and the labour available.

THE traditional method of harvesting, binding, stooking and storing grain was quite satisfactory and economical so long as there was sufficient labour available for it. Under this method, too, the grain did not need to be threshed and put into bags until it was required during the winter and spring: it could be stored long and safely in the sheaf. But that picture is fast changing. Today a single combine harvester reduces the number of men required to two or three, eliminates altogether the handling and carrying of sheaves, and threshes the grain as it is reaped.

To be safe for storage, the moisture content of grain must not be more than 14-15 per cent, depending upon the manner and length of storage. If it is to be kept in bags for a matter of weeks only, then a moisture content of 15 per cent is probably safe; if it is to be kept in bins or silos for most of the winter, 14 per cent is recommended. But the moisture content of grain coming from the combine harvester is nearly always greater than 15 per cent, and therefore some drying is generally necessary. Thus more and more farmers are being faced with the problem of providing modern facilities for grain drying and storage. How best can their needs be met?

Before advice on the subject can be given to any particular farmer, certain basic information must be available. Obviously, it is necessary to know the peak quantity of grain likely to be stored at any one time, and what buildings there are already that might be adapted for this purpose. It is also necessary to find out whether any of the grain is to be used on the farm, because if it is there must be a link between the grain store and the food preparation machinery. It may make a difference, too, if electricity is available.

A point often overlooked in planning grain storage is whether or not the soil at the site of a new grain store is liable to become waterlogged. This is important, because as a rule the design of a grain store includes deep pits for the reception of grain or for machinery. If the level of the water-table in the soil is known to be high and such pits must be included in the design, then they will have to be made watertight.

The next step is to consider the type of grain-handling installation most likely to fit the particular circumstances. Broadly speaking, some means of drying the grain should always be included, and this can be provided in one of a number of ways.

Driers For the farm with a bagger combine and an output of less than, say, 100 tons of grain a year, a *platform drier* will probably suffice. Here the grain is dried in the bags as it comes from the combine, and may afterwards be stored in bags or bulk containers. The advantages of the platform drier are that it is not costly, is all above ground level, and is foolproof in use. Against this, however, a good deal of labour is involved.

For the farm with over 100 tons of grain, there is the *ventilated silo* type of installation. The grain is tipped into a receiving pit, whence it is passed through a pre-cleaner and on into silos, which are so constructed that slightly warmed or dried air can be blown through them. Usually the air passes up from the floor of the silo through the grain and out at the top, but a modern development is to pass the air horizontally through the grain from a duct running up the middle of the silo. It then passes out through the walls or through ducts in the corners of the silo.

The advantages of this method are many. All movement of the grain is mechanized (except bagging off), the whole of the drying, storage and handling equipment is integrated in a compact unit, there is no risk of over-drying the grain, and the drying can be left to proceed for hours without supervision. On the other hand, since the rate of drying is so slow, the operation may stretch over two or three weeks.

For the farm with over, say, 300 tons of grain, it is necessary to have what is described as either a high temperature, continuous or *independent drier*. In this, the grain passes through the machine either vertically or horizontally. In conjunction with this drier there are large silos solely for storage purposes, and the whole unit is both elaborate and highly mechanized.

In addition to these three installations, there are two others which are less common, but which none the less may be recommended in certain cases. They are the tray drier and the ventilated floor methods.

The *tray drier*, as its name implies, incorporates a perforated tray on which the grain is placed loose or in bags. Drying is done by blowing warm air up through the tray. As with the platform drier (of which it is to some extent a variation), storage space has to be provided separately, either in bags or bins, and a considerable amount of labour is involved.

In the *ventilated floor* method the granary floor is used for drying and storing loose grain. Before the grain is put in, a system of movable air ducts (a main duct with branch ducts from it) is laid out on the floor, with the end of the main duct connected to a fan and air heater. The grain is then laid over the floor to an even depth of several feet and dried where it lies. This method is the least costly in the way of initial capital outlay, but the most awkward in the handling of the grain. It also exposes the grain to vermin more than does any of the other methods.

Grain Silos The method of constructing grain silos varies according to the storage capacity required and the building labour and materials available. Relatively small quantities of grain can be stored in the lighter type of pre-fabricated silo made of aluminium, steel, plywood or pre-cast concrete (the last-named in several forms). The pre-fabricated silo does not, as a rule, require special foundations; the floor of a barn will suffice. It has the added advantage of being simple and cheap to take down and move.

Criticism is often directed at circular silos, because, when arranged in rows, they occupy more floor space than square silos. This is undoubtedly true, but it can also be said that a circular bin does not have to be built so substantially as a rectangular one; therefore, a saving in cost may offset the loss of space.

Where large quantities of grain have to be stored, the size of the silos needed frequently exceeds anything which can be provided in a pre-fabricated form. The tall "monolithic", rectangular bin is the obvious solution to the problem of storage on a minimum floor area, but brick or

concrete in some form is necessary. Reinforced concrete cast *in situ* is the safest and best method, but this involves highly specialized construction which is often beyond the capability of the country builder and certainly of the farm worker.

If concrete blocks or clay bricks are used for large silos, they must be designed with special regard to wall thicknesses in relation to height, while the provision of suitable reinforcement between horizontal joints is necessary to help the masonry to withstand the pressure of the stored grain. Internal cross-ties are recommended as a safeguard.

The design of these large structures calls for special knowledge and care if they are to be structurally sound, and it is a wise precaution to employ a qualified structural engineer: failure may easily occur if the work is not properly designed. It may, in fact, be found on investigation that a larger number of small, easily erected silos will be more economical in the long run than a few large ones.

In recent years the majority of the grain silos on farms have been installed in buildings, both old and new. It is now known that such silos can safely stand in the open if the farmer wants to reduce the amount of building work involved. But remember that an outdoor silo must be fitted with its own roof.

FARMING AFFAIRS

Farm and Forest:
13. Fencing Plantations on the Hill Farm

When new plantations are formed or old woodlands replanted, no job is more important than fencing. The type of fence to be erected will, of course, be determined by the animals against which the trees have to be protected, but now that myxomatosis has considerably reduced the rabbit population, sheep netting may take the place of rabbit netting in many districts.

Fencing against farm stock suggests a substantial erection with numerous strands of plain and barbed wire, but such a defence is not always necessary. Hill farmers can usually make do with a simple sheep-stock fence of sufficient strength to keep back sheep and ponies.

The materials required for fencing trees on the ordinary hill farm are as follows:

Stakes. 5½ ft long×3 in. top diameter in cleft oak, chestnut or conifers (in the round) are suitable. Larch and Douglas fir can both be used, but the latter should preferably be creosoted. Allow 7 stakes per chain of fence.

Straining Posts should be 7 ft long with a 5-6 in. top diameter as cut from the log, or cleft or sawn with a 5 in.×5 in. top. They should be in oak, chestnut or larch.

Struts. You will need to strut the straining posts. Such supports should be 7 ft long with a top diameter of not less than 3 in.

Netting. Use sheep netting, 36 in by 4 in. mesh, 14 or 16 gauge as preferred, with a centre strand. Price about 56*s.* 9*d.* per 50-yd roll for 16 gauge wire.

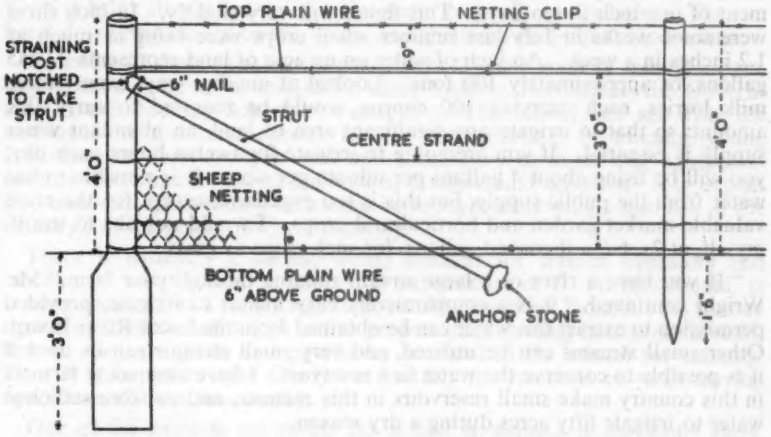
Plain Wire. Plain galvanized wire of No. 8 gauge (approximately 540 yards to a hundredweight). Price about 82*s.* 6*d.* per cwt.

Barbed Wire. 2 ply, 4 point, 4 or 6 in. apart, as preferred. The cost of 2 ply, 4 point, 4 in. apart in 220-yd rolls is about 40*s.* per roll.

Staples. For the plain and barbed wire, 1½ in.×8 gauge (1,000 staples weigh about 17 lb). For the netting, 1 in.×10 gauge (1,000 staples weigh approx. 7 lb).

Galvanized Wire Netting Clips. Obtainable in one gross boxes.

The first job is to erect the straining posts, which should be so placed as to give as straight a line as possible for as far as possible. Sink each post into the ground to a depth of 3 feet and see that it is upright and well rammed in. The distance between posts will depend on the contours and frequency of change of direction. These posts will need a strut, and a notch to take the strut (see diagram) is cut into the post about 12 inches from the top before erection.



Before putting in the stakes, it is best to fix the bottom plain wire. Place the wire in position against the straining post, allowing sufficient to go round it with about 6 inches to spare. A neat job can be made by winding the surplus wire back on itself. Then staple it firmly, strain the wire and secure it to the second post (a chain-link wire strainer can be bought for about 40*s*. and is easy to use). This bottom wire should be fastened to the posts 6 inches above the ground and will give a straight line for the stakes. All wires and wire netting should be so fixed that when pushed by cattle they are pressed on to the stakes and posts and not away from them. Holes for the stakes are made 9 feet apart with a crowbar and the stakes are driven down with a wooden maul. Be sure to keep them upright.

At this stage the netting can be unrolled and lifted up to the stakes, the bottom being placed an inch or so above ground level. Keep it taut and staple up, starting, where possible, at a straining post. The rolls can be joined by overlapping about 9 inches and twisting the loose ends round the meshes.

The top wire is put on in the same manner as the bottom one and placed 1 inch above the top of the netting. The netting is clipped to the top and bottom plain wires with netting clips, which resemble pig rings and can easily be closed with special pliers. These clips keep the netting in position. Only about 2 clips per wire are needed between stakes. Finally, the barbed wire is put on 6 to 9 inches above the top plain wire.

One final word of advice—except when fixing plain and barbed wire to straining posts, staples should not be driven right home: this causes difficulty when carrying out repairs and also starts rusting at the points of contact.

R. E. Pallett,
District Officer, Forestry Commision

At the Farmers' Club: IRRIGATION

In a climate like ours, eyebrows are sometimes raised when a speaker suggests the need for irrigation. But need there is, as Mr. C. S. Wright showed in his talk on March 7. "In this country," he said, "we are usually concerned with irrigation in late May, June, July, August, and early September. Of course, occasionally irrigation is needed in March and April to get seeds started in a very dry season. During those months most crops which are already in full growth and cover the ground, have a water requirement of one inch in ten days. This figure will vary slightly. In fact, there were some weeks in July last summer when crops were using as much as 1.2 inches in a week. An inch of water on an acre of land represents 22,645 gallons, or approximately 100 tons. Looked at another way, twenty-three milk lorries, each carrying 100 churns, would be required to carry this amount; so that to irrigate any significant area of land, an abundant water supply is essential. If you are going to irrigate for twelve hours each day, you will be using about 4 gallons per minute per acre. It is possible to use water from the public supply, but this is too expensive, except for the more valuable market garden and horticultural crops. I would not like to use it, myself, at 2*s*. 6*d*. a thousand gallons, for such crops as grass.

"If you have a river or a large stream running through your farm," Mr. Wright continued, "it is a comparatively easy matter to irrigate, provided permission to extract this water can be obtained from the Local River Board. Other small streams can be utilized, and very small streams can be used if it is possible to conserve the water in a reservoir. I have seen some farmers in this country make small reservoirs in this manner, and so store sufficient water to irrigate fifty acres during a dry season.

"Other sources are lakes, and some ponds, provided they are fed by springs—but the average farm pond does not give anything like a sufficient amount of water required for serious irrigation. An irrigation plant capable of irrigating, say, 50 acres in any one season, will need a lot of water. I remember seeing a neighbour of mine pump water from a pond, and he emptied this pond in about three hours. Another source of supply is a shallow well, but shallow wells with a sufficient water supply to give the quantity required for irrigation are few and far between. In many places boreholes have been sunk for irrigation purposes, and quite often yield sufficient water to cover very large acreages. We are fortunate that the Water Division of the Geological Survey and Museum are only too pleased to assist us by giving us their advice as to whether water can be obtained under our farms or not. One other point about the water supply is that it is essential that the water should be pure and not too alkaline or saline.

"The usual type of pump used for irrigation purposes is centrifugal. This should be placed as near to the water supply as possible, so that it can operate efficiently. It can be driven by a tractor, diesel engine or by electricity. It is very much cheaper and simpler in the long run to use electricity. I have not mentioned petrol engines, because of their comparatively high cost of operation.

"If a large area is under irrigation, electricity or diesel power is recommended. An easy formula to remember is one h.p. for 4 acres, when the land to be irrigated is close to the pump. One word of advice. An irrigation pump puts a heavy load on its engine, so it is best therefore to derate the engine by at least 25 per cent.

"If the water supply comes from a borehole and electricity is available, it is best to use a submersible pump—that is, one where the pump and motor are submerged in the water in the bore. If electricity is not available and

you need to have water from a borehole, a deep well turbine is the only alternative, to be driven by a surface engine."

On May 2, Mr. A. W. Tuke, Chairman of Barclays Bank Ltd., will be reading a paper on Agricultural Finance.

Pakistan Project In the sand and scrub desert of Sind, Pakistan, bulldozers and excavators can be seen at work building roads, dams and canals. The desert, which covers some of the world's oldest civilizations, is being slowly reclaimed. The water comes from the Indus. The sun beats down mercilessly on the scene, and there are occasional sandstorms.

On some of these sites, busily engaged in laying a road or raising a dam, can be seen students of Pakistan's latest training institution—the Government Earth Moving School at Jamshoro. The school, set up with the assistance of the International Labour Organization, is training young Pakistanis to handle, repair and maintain heavy earth-moving equipment such as tractors, excavators, bulldozers, dredgers and scrapers. It is expensive imported equipment which must be brought increasingly into use as the country's development projects multiply.

There is naturally a corresponding demand for trained operators and mechanics, and the school, under the supervision of E. A. Macdonald, is turning them out at a steady rate of about fifty every six months. As trained operators from the school go out to project sites, existing untrained or semi-trained men are given an opportunity to enrol in the school for training. Thus it is hoped to raise slowly but steadily the standard of earth-moving operations all over the country.

One of the projects on which the school is helping is the Kotri Dam. Here, on the site of this big development scheme, mechanical soil excavators and donkeys are working side by side in the digging of canals which, when completed, will bring water to over 2½ million acres of arid land.

The World's Meat Improved pastures and better grassland management are beginning to show their effect on world production of meat. Today world output is over one-third greater than pre-war, says the Commonwealth Economic Committee in a report on meat production, trade, consumption and prices.* Much of the increased output is being consumed in the producing countries (particularly S. America), but, even so, world trade in meat is back to its pre-war level. A good deal of credit for this goes to Commonwealth countries which, in 1954, contributed over one-third of the beef exported and a fair proportion of the mutton and lamb.

The United Kingdom continues to import more meat than the rest of the world combined. In spite of this, consumption per head in the U.K. is still well below the 1938 level and is far less than in Australia, N. America or the meat-producing countries of S. America. For example, the consumption of beef per head in 1954 was 43 lb, compared with 89 lb in the U.S.A., 119 lb in Australia, 175 lb in Uruguay, and 185 lb in the Argentine. The comparative pre-war figure in the U.K. was 55 lb.

* *Meat.* Commonwealth Economic Committee. Obtainable from the Committee at 2 Queen Anne's Gate Buildings, London, S.W.1, from Government bookshops, or through any bookseller, price 5*s.* (5*s.* 3*d.* by post).

SHORT GUIDE TO THE ANNUAL REVIEW, 1956

THE results of this year's Annual Review of the economic condition and prospects of the agricultural industry were published in a White Paper (Cmd. 9721)* on March 15. It describes the production progress made by the agricultural industry during the past year; the changes in the industry's production costs and net income; the Government's production and guarantee policy; some changes in the fatstock guarantee system; the price guarantees determined for livestock and livestock products for the year April 1956 to March 1957 and for crops from the 1957 harvest; and some changes in production grants.

The results of the Special Review, on account of changes in wage costs, which was held concurrently with the Annual Review, are also included in the White Paper. The Special Review determinations relate to livestock and livestock products for 1955-56 and to crops of the 1956 harvest.

GUARANTEED PRICES

Important Note: For the basis of the prices given below and other particulars of the guarantee arrangements see the Notes on Guarantees in Part II of Appendix V of the White Paper (Cmd. 9721).

Livestock and Livestock Products

Commodity	Guaranteed Prices 1955-56, as determined after the Annual Review, 1955	Price Change compared with the 1955 Annual Review Guarantee	Guaranteed Prices 1956-57, as determined after the Annual Review, 1956
	s. d.	*s. d.*	*s. d.*
Fat cattle—steers, heifers and special young cows (per live cwt)	138 8	+12 4	151 0
Fat sheep and lambs (per lb estimated dressed carcass weight)	3 0	+ 2	3 2
Fat pigs (per score dead weight)	51 4 (subject to a reduction of 1*d.* per score in Gt. Britain) related to a feed price of 32*s.* 5*d.* per cwt.	− 6	49 7 (subject to a reduction of 1*d.* per score in Gt. Britain) related to a feed price of 31*s.* 2*d.* per cwt. This pig price is equivalent to 50*s.* 10*d.* related to the 1955-56 feed price.
Eggs — hen (average per dozen)	4 1½† (subject to a small reduction in Gt. Britain)	No change	4 1½‡ (subject to a small reduction in Gt. Britain)
Eggs — duck (average per dozen)	2 9½† †These prices were related to a feed price of 29*s.* 8*d.* per cwt.	− 5	2 4½‡ ‡These prices are related to a feed price of 29*s.* 8*d.* per cwt.
Fleece wool (average per lb)	4 10½	− 2	4 8½
Milk (average per gallon)	3 1.95	+ ½	3 2.45

* H.M. Stationery Office. Price 1*s.* (1*s.* 1½*d.* by post).

CROPS

Commodity	Guaranteed Prices 1956 Harvest, as determined after the Annual Review, 1955	Price Change compared with the 1955 Annual Review Guarantee	Guaranteed Prices 1957 Harvest, as determined after the Annual Review, 1956
	s. d.	*s. d.*	*s. d.*
Wheat (average per cwt)	29 9	−1 6	28 3
Barley (per cwt)	26 0	+ 6	26 6
Oats (per cwt)	24 9	+1 6	26 3
Rye (per cwt)	23 0	−1 6	21 6
Potatoes—ware (average per ton)	217 0	+8 0	225 0
Sugar beet (per ton, 16.5 per cent sugar content)	128 1	+2 5	130 6

PRODUCTION GRANTS

The existing production grants, amounting to about £60 million a year, are being retained and the following increases are being made:

Fertilizer Subsidy. New rates of subsidy for nitrogen and phosphates will be fixed from July 1 next involving additional payments of £3 million.

Marginal Production Scheme. The maximum rate of grant for work on marginal farms will be increased, involving additional expenditure of about £1 million in a full year.

Calf Subsidy. The rate of subsidy will be increased to £8 10*s.* in respect of steer calves born on or after April 1, 1956.

Silage. Provision is being made for the payment of grants up to £200,000 in 1956-57 for the construction of silos under a scheme to come into operation in the autumn of 1956.

FATSTOCK GUARANTEES

The Government have decided to simplify the fatstock guarantee system by dispensing with the individual guarantees, and the equivalent deadweight guarantees, for all classes of fatstock. This will also mean that in the case of pigs the present complex of the individual guarantee, the market addition, and their deadweight equivalent will be eliminated.

New guarantee arrangements for all three groups of fatstock (cattle, sheep and pigs) will be introduced from March 26, 1956. For each group there will be a single deficiency payment which will be adjusted as and when necessary to ensure that the average return to producers each week remains within the following ranges on either side of the respective standard prices:

Cattle, 23*s.* 0*d.* per live cwt; Sheep, 4*d.* per lb dressed carcass weight; and Pigs, 5*s.* 0*d.* per score dead weight.

IN BRIEF

The Nurse Cow

Multiple suckling can vary in intensity from twinning on an extra calf and allowing it to be suckled the whole season, to rearing three or four calves for nine to twelve weeks on a cow and then replacing them with a further but smaller number. Using relays of calves in this way, a heavy milking cow may rear as many as twelve calves in a year, although six or seven is more usual. Not all cows, however, take kindly to calf adoption, especially some that have been used for milking in previous lactations. If they are tied up and fed concentrates when the calves are put to for suckling, the desire for palatable food and the mass attack of hungry calves usually proves too much and they give in. But once a cow has proved herself a good foster-mother she can be used for this purpose for several seasons. A guide to the number of calves which her yield will enable her to rear can be broadly assessed by hand-milking for a few days after the first batch of calves is weaned at 10-12 weeks.

Often, because a nurse cow's milk yield is unknown, she is underfed compared with her sisters in the dairy herd. If the calves are thriving it is safe to assume they are each receiving at least a gallon of milk a day, therefore nurse cows must be fed accordingly. A cow rearing four calves should receive daily an ample ration of roughages, such as good quality hay and silage, plus 8-10 lb of balanced concentrates.

Toxic Chemicals Insurance

Chemicals of all kinds are being used increasingly on our farms—especially for fumigation, and as sprays and dusts to control diseases and pests. Whilst many are innocuous, some of them can be very dangerous to workers, livestock, and third parties unless they are used with the utmost care. Even if all precautions are taken, however, the possibility of third party liability cannot be ruled out, and an article in the *Financial Times* of March 5 reminded readers of the need for adequate insurance against this risk, since substantial compensation may have to be paid if negligence is proved.

"The farmer or market gardener who purchases chemicals and apparatus for use by his own labour needs to be protected by third party insurance in respect of damage to the property of other persons and in respect of injuries which may be caused. He also needs to effect insurance on his employees in case they may suffer injuries.

"Policies for all the various risks associated with the use of chemicals are undertaken by insurance companies. Except where the quantities handled and the extent of the work is very great, a modest annual premium will secure substantial cover."

Nuclear Plant Breeding

Better cereals may come out of work being carried out at various centres in this country if present experiments of irradiating wheats, barley and oats by radio-active isotopes are successful. The more pedestrian way of improving cereal and other plant varieties is by cross-fertilization, to produce a genetical recombination in the progeny of selected parents. By the nuclear approach, the genetical structure is changed and thus the resultant progeny may be greatly dissimilar to their parents.

Labour and the Potato Harvester

Field experiments made by the National Institute of Agricultural Engineering emphasize the importance of maintaining a high rate of feed to pickers working with a potato harvester. When manual separation is relied upon to produce a clean sample, a fast rate over the ground is therefore essential to get the best output per man. This, in turn, demands a large team of pickers (probably four for short periods and at least six for all-day picking), with one at the end of the conveyor belt to ensure that nothing is missed. If the available labour force is small, lifting and cleaning is best done in two operations: the alternative is a potato harvester which cleans automatically.

As a general guide, ½ acre per hour is regarded as the minimum rate for efficient use of labour. Allowing for a 15 per cent loss of time at headlands, this means a forward speed in the row of 2 m.p.h. (or 1 m.p.h. for two rows), and a feed to the first picker of 400 lb of potatoes a minute.

Other observations during these experiments showed that potatoes were best swept off the conveyor, rather than grasped; that when there is a lot of rubbish, a fast belt speed which gives an "open" mixture is preferable; and that there is a little to be gained by different arrangements of the pickers at the belt.

Beet Silage for Danish Pigs

For several years the National Research Institute on Animal Husbandry in Denmark has been experimenting with a new kind of bulky fodder for pigs, designed to reduce the loss of dry matter in beet when kept for later use. By making the beet into silage instead of keeping them whole, the loss was cut down to half. The silage consists of shredded fodder sugar beet mixed with 10 per cent ground barley. An alcoholic fermentation results, leaving the silage with an alcohol content of up to 1.9 per cent when fed. The feeding value of the dry matter is equal to that of ground barley. No alcohol has been found in the blood of the pigs, no offensive taste has occurred in the bacon, and no difficulty is encountered in getting the pigs to accept this fodder.

Semen for Export

One of the most important possibilities of the deep freezing technique (for A.I.) lies in the export of semen. Time ceases to be a factor of importance and semen can be shipped to any part of the world and stored until required. Quite apart from areas to which live exports are already sent, there are vast areas of the world where European breeds will not survive but where improvement of native stock by crossing is urgently required. The export of frozen semen could be the answer to the problem.

In areas to which animals are already being exported it is only natural that the breeder will raise opposition on the grounds that his livelihood is being menaced. This attitude, although quite understandable, will be disastrous if continued. For, while the issue of licences for the export of semen may well be restricted in this country to conform with Breed Society wishes, no such restriction is likely either on the Continent or, more particularly, in America. There is already ample evidence that overseas breeders wishing to import semen from Britain are tiring of the restrictions and difficulties put in their way and are turning to other countries.

L. E. Rowson, Guernsey Breeders' Journal

Festival of the Trees

A reminder to the Italian people of the importance of forests in the economic life of the country and so imbue a love of nature and a respect for plant life, especially among the young, is given every year by the traditional Festival of the Trees. The Festival was instituted by Guido Bacceli, then Minister of Education, in 1899, subsequently lapsed, and was revived in 1948. About 7,000 communes now observe it; nearly two million school-children take part and some 1,300,000 trees are planted.

In addition to its educational value, the Festival has the very practical effect of enriching Italian timber resources by regular planting. The area under forests in Italy is less than 20 per cent of the total—a much lower percentage than in many other countries. At the same time, Italy is very densely populated, and the country uses much more timber than it can produce. Large imports from abroad are a heavy burden on the foreign trade balance. The present forest area can produce about 10 million cubic metres of timber. The amount cut each year is much greater; in 1946-47, it was almost 15 million cubic metres. Measures must therefore be taken to protect timber resources—by more re-afforestation and by planting fast-growing species.

The educational campaign which accompanies the Festival also helps to show how forests give protection against avalanches, land-slides and floods; their importance for soil conservation purposes; how they produce various products essential to everyday life; their role as summer and winter resorts; and the way in which they can help to make an area more healthy.

Who sows a field or trains a flower,
Or plants a tree, is more than all.

Whittier

Tuberculosis Eradication

Approximately 62 per cent of cattle in Great Britain are now attested—in England 54 per cent, in Wales 84 per cent, and in Scotland 79 per cent. This is a total of 6 million cattle in attested herds and attested areas, as compared with 5 million at the end of 1954 and 2 million in October 1950, when the Area Eradication Plan was introduced. The plan progresses steadily. In two years' time it is the intention to declare as T.B. Eradication Areas, Kent, East Sussex, Dorset, Somerset, Wiltshire, part of Devon, East Lothian, Roxburgh, Berwick and part of Perthshire. Free tuberculin tests are now available in these areas to encourage voluntary attestation, leading to clean herds and the payment to farmers of a bonus under the Attested Herds Scheme. The bonus is 2*d.* a gallon on milk sales for four years, followed by 1*d.* a gallon for a further two years; or a capitation bonus of £2 per head of cattle per year for four years, followed by £1 per head per year for a further two years.

Sheep for the Antarctic

Australian breeders are trying to develop breeds of sheep which can be acclimatized in the cold areas in the south of the continent. A number of sheep and rams are being sent as an experiment to an island 1,000 miles south of Tasmania, where their reaction to these conditions will be studied.

BOOK REVIEWS

Pictorial Poultry Keeping. DENYS DE SAULLES. Pearson. 15*s*.

As the title of the book suggests, the pictorial method of presentation has been used to describe contemporary poultry-keeping in all its branches. No less than 467 photographs are included and these are generally well chosen. The illustrations are supported by clear and concise descriptive matter, and the publishers are to be congratulated on the attractive format, clear print and high grade of paper used. The book is, however, intended primarily for the domestic poultry-keeper or to whet the appetites of teenagers toying with the idea of poultry husbandry as a career. The text is too elementary to interest the commercial poultry-farmer.

A large part of the book deals with the brooding and rearing of chickens and the housing and management of laying stock. Incubation, feeding, breeding and diseases are treated very superficially. No mention is made of cabinet incubators or of mechanical aids in the wet or wax plucking of table poultry. Indeed, production aspects of table poultry are summarily dismissed and, in contrast, the dressing and trussing of chickens is over-elaborated, with notes on cooking thrown in for good measure. There are also short sections dealing with ducks, geese and turkeys, together with some brief notes on guinea fowl and bantams.

The text is not without its inaccuracies. The determination of the sex of day-old chicks on the basis of wing feather development is by no means as precise as suggested; nor are there any obvious indications that autosexing breeds are rapidly increasing in number. Similarly, in the list of sex-linked crosses given in the appendix only black varieties are included in crosses involving the use of non-barred males, whereas Rhode Island Reds or Brown Leghorns could be used, and would be preferred to Black Minorcas or Black Orpingtons on economic grounds.

No mention is made in the description of breeds of turkeys of the broad-breasted variant of the Bronze breed, which has attained considerable popularity in recent years.

The index is adequate in view of the pictorial presentation, but a sample check for accuracy failed to reveal any reference to " deep litter " on page 32. In fact, this page appeared to be concerned exclusively with batteries for laying birds.

H.T.

Game and the Farmer. Imperial Chemical Industries.

The contents of this attractively presented booklet bear the imprint of the practical man, and the suggestions made for the betterment of game stocks are all well within the powers of those whose main purpose is the cultivation of land and the rearing of farm stock. With the help of fine illustrations and a readable text, the reader is given guidance of the various aspects of maintaining and improving game stocks. Methods of vermin control are followed by suggestions for the improvement of nesting cover and nest protection. That the book is up-to-date is shown by the reference to the possible effect on game of modern insecticides and weed-killers, and by the notes on simple precautions which can be taken to reduce the risks to wild life. Restocking by rearing is described in detail and useful suggestions are made for the all-important job of holding the stock on the farm during the winter.

Considerable, but not too much, emphasis is laid on the need for systematic and planned vermin control in the protection of existing stocks and their progeny. Vermin control is now recognized as an operation integral to good farming, and it is interesting to see that what might otherwise be regarded as a " chore " can contribute so greatly to future pleasure.

There is, however, in this section, no reference to the depredations of the grey squirrel on both eggs and poults. This pest can be taken in tunnel and cage traps, and reference to these should be included in the " strategic network of traps " mentioned in the text. Perhaps the writer would consider including the point in future issues.

Copies of the booklet are obtainable free from Imperial Chemical Industries, Game Research Station, Fordingbridge, Hants.

C.D.H.

BOOK REVIEWS

A Plough on the Mountain. LAWRENCE MORGAN. Odhams. 12*s.* 6*d.*

Since the war many people have turned to the hill and upland areas of this country to find a life in farming. Some have chosen these areas because they offered the best, or perhaps the only, opportunity of getting a foothold on the farming ladder, especially if capital is limited. Others have undoubtedly been attracted by a romanticism of the hills, coupled with a desire to escape from more intensively organized methods of earning a living. Whatever the reason for deciding to follow this new way of life, many of these " amateur " farmers have finished up sadly disillusioned, and financially impoverished, due often to a lack of farming knowledge and ignorance of local living conditions.

Mr. Morgan, on his arrival at *Cefn glas*, would probably be the first to agree that he, too, was an amateur, so far as practical hill farming was concerned. But he certainly seems to have acquired considerable knowledge of farming practice in various other parts before actually starting to farm himself. With this acquired knowledge and his extreme good fortune in having a knowledgeable and helpful farmer neighbour, whose advice he had the good sense not only to seek but also to follow on innumerable occasions, Mr. Morgan appears to have avoided the many pitfalls into which so many would have fallen. Consequently, he has written a book which is not only very easy and pleasant to read but which contains a great deal of sound common sense and advice for anyone proposing to take over a similar farm. Mr. Morgan claims to have had a " feeling " about *Cefn glas* when he walked it as a prospective buyer. One of the attractive features of his book is that he very successfully conveys this " feeling " to his reader, not only in describing the derelict state in which he found it, but also in the way in which he brought back life, activity, fertility and production to this deserted holding.

The various technical aspects of farming which he describes are not only sound but also up-to-date, even though some of the numbers of the Aberystwyth strains mentioned in his seeds mixture are incorrect. It is interesting to note that his neighbour, Mr. Price, is a keen advocate of foggage—a practice which he had learned from his father and grandfather and not as a " novel " idea from recent research.

Mr. Morgan's efforts to secure a quick turnover and cash return on a poor upland farm through pigs and poultry could well be more widely adopted on this type of farm, although perhaps not always to the extent of establishing a farm-to-table service of " Welsh chicken " dressed and in a transparent wrapping. Welsh cattle, sheep and pigs have a strong advocate in Mr. Morgan, who seems to have been very fortunate in his initial purchase of Welsh Black cattle. One of them, Olwen, becomes quite an attractive character in the book. The high regard in which the author holds her is obvious from his self-sacrifice in giving her his only half-bottle of whisky after rescuing her from a bog! Surely he, too, deserved at least a " wee nip " for his efforts on that occasion.

It is a pity that the book ends after describing only a little over six months of the farming year, but perhaps more is to follow. If it is anywhere near as good as this, it will certainly make interesting and enjoyable reading.

W.E.

Russian Comfrey Report No. 1. L. D. HILLS. Doubleday Research Association. 3*s.*

The Henry Doubleday Research Association has been formed to investigate and publish the virtues of Russian Comfrey (*Symphytum peregrinum*, Ledeb, Order, Boraginaceae) as an agricultural crop. This, as the title indicates, is its first report on the subject. Russian Comfrey is a hardy tap-rooted perennial, established by planting root portions. The high cost of establishment (£85 an acre, ignoring labour) must be set against the claim of a productive life of twenty years. Full production is reached in three to four years from planting.

The report includes sections on cultivation, yields, conservation, chemical composition, feeding, and on the future research programme of the Association.. There is an appendix on the problem of destroying unwanted comfrey. The biggest section (14 pages) gives the yields in 1954 of fresh herbage from thirteen small plots in the United Kingdom and Eire, and from five in Kenya, Southern Rhodesia, South Africa and New Zealand. The presentation of the details for each centre, however, is unsystematic and incomplete, and too much space is devoted throughout to unnecessary incidental information, much of it irrelevant. The agricultural history of the plant and of its near relatives is scattered throughout the report, and in some yield comparisons it is not made clear that different species of comfrey are involved.

It is plain, however, that the crop is potentially highly productive. In Britain the average yield per acre of fresh herbage for the whole season, estimated from samples, was 29 tons. The three heaviest yields (average 52 tons) were found in the only centres where the age of the stand was three years or more. Dry matter yields are not given, but at a dry matter content of 12-15 per cent, the average dry matter yield per acre would be about 3½ tons.

Some original analytical figures are given, and others are quoted to show that, compared with grass, comfrey has a high crude protein content and low dry matter and crude fibre contents, but a low starch equivalent. Its very low dry matter content means that it cannot easily be made into hay, and the cost of drying is exorbitant. For all these reasons its value is limited in grassland husbandry where protein is not generally scarce. In the section on feeding, the author rightly suggests that comfrey is less likely to be of value to the dairy herd than to some of the other farm stock, and he stresses the possible virtues of the plant for non-ruminants, especially pigs.

While it is most creditable that such an effort should be made privately to assess the agricultural virtues of a neglected plant, it is to be hoped that future reports from the Association will be more concise, that they will be delayed until several years' yields and costings are available from adequate acreages of fully established crops, and that more attention will be paid to the utilization of the crop by the animals to which it is most suited.

D.S.M.

Potassium Symposium, 1954. International Potash Institute, Berne. 25*s*.

This publication of over 400 pages includes 21 papers (with abstracts in English, French, German and Spanish) read at the annual session of the Technical Board of the International Potash Institute at Zurich in July 1954. It also contains a list of the 750 authors quoted and a subject index in four languages. The Institute was founded in 1952 to disseminate knowledge, based on published reliable data, concerning the chemistry and nutrient requirements of soils, with particular reference to potash.

The wide range of subjects discussed at the conference is indicated by the titles of some of the papers: "Potassium in the Soil", "Potassium in Plant and Animal Organisms", "Potassium in Practical Agriculture", and "Methods of Potassium Analysis". The papers on potassium in the soil largely centred around the problem of potassium fixation. What is known as "fixed" potassium is the portion that is not immediately available to the plant, as opposed to "exchangeable" potassium that is bound to the surfaces of clay particles in the soil and is readily available to the plant by the process of base exchange. The "fixed" potassium is held chiefly in the soil by certain clay minerals—namely, illites. The term "illite" would appear to include several forms of clay mineral varying in their capacity to hold potassium in a non-exchangeable form and release it to the growing crop.

The fixation may be slight in acid soils but it appears to become stronger as the lime status of the soil improves. Recent evidence indicates that it may be possible to diagnose potash-fixing soils and their degree of potassium-fixing capacity from the presence of the kind of illites in the soil clays. It is assumed that no more than half the applied potash, on the average, is recovered in the first year or two after application. The remainder is locked up and becomes available only slowly. It is the amount of exchangeable potassium that primarily determines the potassium status of the soil and its need for dressings.

The plant physiology data discussed suggest that the role of potassium in the plant is associated intimately with photosynthesis, or the manufacture of sugar or starch in the green leaves and other green parts of the plant. The largest amount of potassium in the plant is found where active photosynthesis is proceeding. Another function attributed to potassium is to increase the turgidity, permeability and hydration of the living soil. This may partly explain the particular value of potassic dressings in dry seasons.

The more essentially practical papers revealed that the consumption of potassium in Denmark and Belgium has increased about twelvefold since 1910. The total consumption of potassium in Great Britain shows a similar increase in the same period, but per acre of agricultural land the amount used is not much more than about one-quarter of that in Denmark or Belgium, thus indicating scope for expansion in this country.

G.A.C.

BOOK REVIEWS

Weeds (2nd Edition). W. C. MUENSCHER. Macmillan. 70*s*.

This book deals with the weeds of the United States of America in much the same way as Bulletins Nos. 41 and 108 of the Ministry of Agriculture have dealt with weeds in Britain. The general principles of the origin, spread and control of weeds in the U.S.A., discussed concisely in Part I, are applicable to British weeds, but naturally some of the details are not relevant to Britain—for example, the references to weed legislation in America and to weeds of rice fields. There are also some surprises for the British farmer, such as the inclusion of *Holcus lanatus* (Yorkshire Fog) in the list of poisonous plants. The emphasis throughout is on control by cultivations. The use of herbicides is not discussed, but references to Canadian and American publications, some with extensive bibliographies, are provided for anyone wishing to pursue the subject.

Part II contains descriptions of nearly 600 species regarded as weeds in the U.S.A. About a third of them occur in Britain, though not all are looked upon as weeds here, and some of our common weeds are omitted. For example, *Alopecurus pratensis* (Meadow Foxtail) is mentioned but *A. agrestis* (Black Grass) is not. The species are grouped in botanical families, and each is described under its Latin name, followed by its American common names, some of them unfamiliar (even confusing) to British readers. The habitat, distribution in N. America, and notes on control are given, and the special features of over 300 species are illustrated by excellent line drawings. There is a workable key for identification and the botanical terms used are explained in a ten-page glossary.

In short, this book should help botanists interested in the weed flora of the U.S.A. or in identifying unfamiliar weeds which may have been imported from N. America, but for farmers trying to identify and control common British weeds on their farms it is no substitute for the old bulletins of the Ministry of Agriculture.

J.M.T.

Chemistry of Crop Nutrition (Ninth Dalton Lecture). SIR WILLIAM G. OGG. *Royal Institute of Chemistry*. 3*s*.

The Dalton Lectures were instituted by the Manchester and District Section of the Royal Institute of Chemistry in 1944, on the centenary of Dalton's death, to perpetuate his memory. The lectures are now held under the auspices of the parent body, but the Manchester Section continues to advise and co-operate. The Ninth Lecture was delivered in the Town Hall, Manchester, on October 28, 1955, and, as is usual on such occasions, exhibits illustrating practical applications of chemistry were staged by various industrial and research organizations.

Since the object of the lecture is to inform the public on the great part played by the science of chemistry in the life of the community, it is fitting that a lecture early in the series should be concerned with the part that chemistry has played in increasing crop production to meet the needs of an ever-expanding world population. It is also appropriate that the lecture should be given by the Director of the Rothamsted Station, where modern agricultural research originated, and which played so great a part in the application of chemistry to problems of soil fertility and crop production.

The lecture is essentially a review of the chemical aspects of crop production, beginning with the early ideas on plant nutrition of Van Helmont and Davy, and the contributions of de Saussure, Boussingault, Liebig, and Lawes and Gilbert, which laid the foundations of agricultural chemistry and field experimentation on crops.

The progress made subsequently in the chemistry of crop production is reflected in the phenomenal increase in the consumption of nitrogenous, potassic and phosphatic fertilizers, which is illustrated in the lecture by the figures for the United Kingdom over the period 1913-54. In addition, the progress made in the use of other elements in increasing crop production, including calcium, magnesium, sulphur and the trace elements, is outlined.

The problems surmounted and the progress recorded should leave no doubt in the mind of the layman of the debt owed by the community to the chemist in utilizing man's heritage—the soil—to provide food and clothing in ever-increasing amounts.

The lecture concludes appropriately with a short discussion of the need for both organic manures and chemical fertilizers, in complementary roles, to meet the continuously increasing demand for food, and simultaneously to maintain or raise the level of soil fertility throughout the world.

Copies of the booklet are obtainable from the Institute, 30 Russell Square, London, W.C.1.

T.W.

BOOK REVIEWS

The Farmers' and Farm Students' Handbook. JAMES GUNSTON. Odhams. 18*s*.

First impressions on looking through this book certainly seem to support the publisher's claim that it is " comprehensive, concise, inexpensive and compresses within its covers a great mass of vital facts, figures and statistics ". Closer study, however, reveals some unfortunate omissions.

The section on grasses and clovers is certainly long, but confusing by its very comprehensiveness. Most of the regional prescriptions for seeds mixtures have a West Country flavour, and little emphasis is given to the needs of the farmer in the drier east. New Zealand short-rotation ryegrass (H.1) is given one small reference, but no mention is made of S.22, and a suggestion that yarrow should be included in all permanent pasture mixtures is not supported in the text. A categorical statement that sheep should not be allowed on young seeds is rather misleading; it is common practice on the light soils to obtain consolidation by these animals eating off a light seeding of oats.

Generalization about the cultivation of special crops may lead to complete failure in practice, and in the case of lucerne the advice that it can be drilled in any month from April to August is dangerous. The subsequent suggested management is, to say the least, debatable.

The section on livestock contains some useful practical suggestions, even if the main emphasis is upon breeds and diseases; but the inclusion of a chapter on the garden and orchard seems a little out of place, although, like the next on beneficial birds, it contains some interesting information. There is also need for a more up-to-date approach to the subject of insect pests. Although *gamma*-BHC dips are mentioned for the control of ticks, the only advice given for the strike maggots is " to wage war on the green-bottle fly ". Unfortunately, there is no reference to the use of DDT sprays. In the same way, the out-of-date and very poisonous Paris green is still advocated for cutworms and leatherjackets.

To many who had hoped to profit from Mr. Gunston's lifetime of farming experience, this book will come as a disappointment, for obviously he has a wealth of personal and independent views. His book, however, lacks the authoritative approach. The debt that he owes and acknowledges to the many excellent publications on modern commercial farming is very pronounced. His real achievement has been the selection and assembly of so much information in a single book.

E.C.P.

Modern Irrigation. A. J. CRIBB. Elliot. 6*s*.

Modern Irrigation is intended to give farmers some idea of what irrigation entails and how to set about it and so ultimately to increase their production and profits. The book is compiled effectively in conversational form, but much of the information is laboured. It is unfortunate, too, that greater emphasis is not given to the technique of the application of water, and one cannot help noticing that such little information as is given is second-hand and most of it unreliable.

An irrigation plant which is not used properly can be a menace, and there are many things which must receive attention before irrigation is embarked upon—soil structure must be in perfect condition, fertility must be high, and drainage must be good. The application of artificial rain and the maintenance of soil moisture is not an easy operation.

On page 93 it is suggested that a lettuce crop must receive the equivalent of ½ inch of rain per week. On page 48, in the answer to the question " Could we scorch plants by irrigating during a hot sun?" the reply is given as " No ". The correct answer would have been " Yes ", and in hot weather it would be fatal to apply water to a growing lettuce crop during the whole period of its growth. If the equivalent of 1 inch of rain is given before sowing, provided the fertility is high and a dust tilth is maintained after sowing, no further application of water is necessary; in fact it can do a lot of damage.

Water should not be applied to the land quicker than the soil particles can absorb it without creating a muddy condition, and land should not be flooded. In its application, the water should be suspended in the atmosphere for as long as possible, so that it becomes aerated.

F.A.S.

BOOK REVIEWS

The Fruit Year Book, 1956. Royal Horticultural Society. 10*s.*

This new number, dedicated to Professor B. T. P. Barker, caters for a wide range of interests, commercial and amateur. Dr. Robb-Smith has done a service to pomology by clearing up ambiguities surrounding the Blenheim Orange variants in a fascinating and scholarly paper. It would, however, be useful to have leaf stalk characters added to his varietal descriptions, since the very short stalk noted in Thompson's (1827) description is so characteristic of at least some present-day Blenheim trees. Flower characters might also help to corroborate fruit characters. Mr. A. P. Preston reviews ten years of experimental work at East Malling Research Station on the pruning of apple trees, and in another article on "The Training of Apples", he explains the practical pruning techniques very helpfully. Two other East Malling workers record pruning experience with fan-trained peaches, based on Mr. C. T. Woodward's methods (*The Fruit Year Book*, 1947). Mr. Gavin Brown makes a plea for "sport-consciousness" and points out the practical importance of keeping a keen look-out for new and useful bud sports in plantations and orchards.

West Midland orcharding from Mr. Clift and apple-growing in Canada from two East Malling visitors are interesting records of old and new world enterprises. A review of bird damage and its prevention suggests the urgent need for a proper study of bird behaviour and responses, to which the most obvious contribution made so far is that "familiarity breeds contempt" for the various contraptions devised for frightening marauders.

Amongst other articles, there is an intriguing note for the curious on Isaac Newton and his apple from the pen of the late Sir Stephen Tallents, and an equally absorbing one from Mr. Howard Crane on Sir Francis Bacon, who, it has to be admitted, had greater qualities as a statesman than as an experimental pomologist. Altogether, this is a very useful volume for the fruit grower's bookshelf.

R.T.P.

Farm Weeds (Second Edition). Shell Chemical Co. Ltd. 5*s.* (5*s.* 6*d.* by post).

Sixty of the commoner weeds with which farmers in this country are likely to be troubled are colour illustrated in Shell's *Farm Weeds*. Modern methods of weed control demand early identification, so that the right chemical treatment can be given at the right time, and it is here that this booklet will be found very useful indeed. The diverse, and often quaint, names under which the various weeds are known in various localities are listed, together with the characteristics of the plants and cross-references to the relevant coloured plates. Thus farmers can browse through it with profit, before being stimulated to action in the field, and students will hail it as a boon to their studies.

Copies can be bought from the Publications Department, *Farmers Weekly*, 43 Shoe Lane, London, E.C.4, or Landsman's Library, Buckden, Huntingdon.

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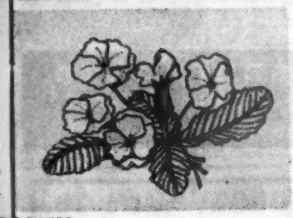

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